Electrical World and Engineer

THE CONSOLIDATION OF "THE ELECTRICAL WORLD" AND "ELECTRICAL ENGINEER."

VOL. XXXVII. NEW YORK, SATURDAY, JANUARY 26, 1901. No. 4.

PUBLISHED EVERY SATURDAY BY

ELECTRICAL WORLD AND ENGINEER
(INCORPORATED.)

120 LIBERTY STREET, NEW YORK.

TELEPHONE CALL: 4044 CORTLANDT. CABLE ADDRESS: ELECTRICAL, NEW YORK.

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ELECTRICAL WORLD AND ENGINEER.

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Entered as second-class mail matter at the New York Post Office.

NEW YORK, SATURDAY, JANUARY 26, 1901.

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DR. ELISHA GRAY.

Without question, Dr. Elisha Gray, whose sudden death occurred this week, was among the notable electrical inventors of the past century, while his early activity in the industrial field of electrical application was attended with important results. It is to be regretted that his later years were darkly embittered by the feeling of injustice done him in the matter of the telephone; and that he should have died a very poor man. The absence of wealth did not bother him much; but he did not hesitate to express the belief that more credit for the great invention of the telephone was his due. His own language, written within a few days of his death, is quoted elsewhere in this issue. And yet the evidence in support of the claim of fraud against him cannot be called strong, based as it practically is on the extraordinarily improbable story of Wilbur. But while that affidavit, discredited by its own author, is regarded by many as a clever contribution to the literature of magazine "short stories," by others it is taken simply as a proof of the corruption by which a great genius was cheated out of his rights. We fear that the Bell-Gray controversy will linger like the Morse-Vail, and others, such as that on the invention of the dynamo-electric machine, of which we are reminded at this very juncture by the arrival from England of a private pamphlet issued in behalf of Wilde. These disputes are, it would seem, inevitable; they are none the less deplorable.

NORTHWESTERN ELECTRICAL CONVENTION.

At the recent Convention of the Northwestern Electrical Association two topics appeared to engross largely the minds of the members, judging from the lively interest manifested in their discussion. These related to threatened legislation adversely affecting Wisconsin central stations—representatives of which form the main body of the membership of the Association—and competition from gasoline street lights. It seems that a necessity exists for increasing the revenues of the State, and among the interests singled out for increased taxation are central stations and electric railways, a bill now pending proposing to increase the present levy on these by 50 per cent. The main interest in the discussion, aside from its local bearing, lay in bringing up the question of publicity of central station accounts. Some of the members objected to the method of assessing a tax on income, the exposure of which without an accompanying statement of expenses, would in some instances give rise to public agitation on the score that the showing indicated undue profits.

There is little doubt that much of the strength of the municipal ownership movement in the West and elsewhere is due to false ideas as to the profits derived from electric lighting. Viewing electricity supply as a public utility, the matter of the profits enjoyed from the business has, particularly in the West, been considered as coming within the province of the people for discussion, and, if need be, for action—which thus far, when adverse, has consisted in the establishment of a municipal plant or the granting of a competing franchise, thereby in many instances destroying the investment in the private plant affected. In popular discussion which so often leads to such calamitous consequences, the central station unhappily occupies a weak position in that any claims as to exorbitant profits, whether in direct statement or as deductions from comparisons with other plants, are apt to receive credence from the people as against what will in most cases be considered as merely *ex parte* statements from the other side.

If, on the other hand, publicity were given to central-station accounts, as is done in Massachusetts, not only would there be a check in the first instance on demagogic charges, but means would be furnished the fair-minded to determine, both directly and by comparison of plants, if a central station is open to criticism on the score of undue charges. Moreover, the mere publicity of accounts would allay the jealous suspicion with which central stations are viewed when conducted on the principle that, as in purely private business, their balance sheets are to be carefully guarded from the public. To our mind, the greatest boon that could be conferred on the central-station industry would be the enactment of laws in all States similar to those under which, in Massachusetts, central-station accounts are given publicity in annual reports.

As to competition from gasoline street lighting, the discussion abstracted in the convention report indicates that thus far it has not assumed a serious aspect. It is not a little astonishing that the underwriters have permitted this dangerous method of illumination to be applied in interior lighting. In the discussion a number of instances were reported of fires resulting from the use of gasoline for interior lighting, this testimony in itself being sufficient to call for an investigation by the insurance interests.

The Victorian Era.

That period of time which will always be known as the Victorian Era and which coincided almost exactly with three-quarters of the nineteenth century, has come to a close this week with the death of aged Queen Victoria, than whom a more noble and virtuous sovereign never occupied a throne. We join at such a season in the universal grief, and offer sympathy with our English friends in this hour of their deep national affliction. The electrical inventions of Victoria's reign have done much to bring the English and American peoples together; the historian must go back far into Colonial records to find such cordiality as now exists, a cordiality to which the influence of the Queen contributed powerfully. Long may such relations continue through the days of Edward VII.!

We note of late a strain of depression in the language held by contemporary English statesmen and journals as to the British outlook as the good old Queen passes away. They seem to feel that with her death end the days of progress, prosperity and expansion that have endured these 50 years, and that now the troublous times begin. Such sentiments strike us as rather morbid, especially if we compare the position of England now with what it was at the beginning of the last century. Even if she never added an inch to her territory, England has infinite possibilities of growth under her own flag; and while her stolid indifference to new competition in arts and industries has lately been a puzzle, she has within herself the rich elements of a splendid recuperation. That England should thus hold her own under Edward VII. is all that patriotic Americans wish for her; so that both countries may go forward in mutual respect, generous rivalry and a swifter development than ever of all the boons of civilization, neither last nor least of which are the arts and sciences that we date from the Englishman, Faraday.

Mail Tube Systems.

It is announced from Washington that the Post Office Committee of the House in reporting the Postal Appropriation bill has left out the item for pneumatic tubes. It appears that the Government has been paying $225,000 a year for this service. In New York the expense has been $160,000 for five miles; in Philadelphia the distance is three-quarters of a mile, and in Boston it is half a mile. Apparently the trouble and cost have been such as to beget a prejudice in the Committee that could not be overcome, Chairman Loud saying that they thought the Government "was not getting enough for its money." This action has been taken in spite of the fact that a special committee of experts and well-known business men appointed by the Postmaster-General reported recently in favor of extensions in other cities after an exhaustive investigation. The Merchants' Association of New York has also protested against discontinuance, and has begged the New York delegation in Congress to ask and work for the maintenance of the system, on the score of its undeniable advantages.

It has always seemed to us that while the tube system is an indispensable feature of mail service in cities, it need not be pneumatic. The tube system is independent of all delays of the street traffic, weather, parades, etc., and can be availed of instantly at any hour of the day and night. But the pneumatic method which is apparenly very expensive, and evidently gives a great deal of trouble, can be readily supplanted and replaced by simple electrical apparatus; and it is really surprising that the new departure in this direction was not made long since. We note that a plan has just been put forward of this kind for adoption in one of the largest cities in the Union, and there is no good reason why it should not work out admirably. It is but another development of the traction work in which electricity has more than proved its ability to do the tasks that compressed air could not do; and running in tubes the motors would operate under most favorable conditions. We trust sincerely that the tube mail transportation will not be abandoned, but for the more expeditious delivery of mail, be extended under electrical conditions in all the large cities. The field is an excellent one for electrical occupation.

Cosmic Electrical Phenomena.

A letter from Prof. Elihu Thomson, appearing in our correspondence columns last week upon the subject of cosmic electric phenomena, shows that the suggestions of an electrical origin for terrestrial magnetic storms, solar coronas and auroral streams have been floating in the minds of observers on both sides of the Atlantic for several years past. It seems to have been noticed, and to be now demanding general recognition, that an enormous mass of matter like the sun, insulated in space and undergoing violent changes of superficial energy is likely to give rise to powerful electrical phenomena in addition to thermal and chemical phenomena. It would certainly seem strange, when the matter is regarded from this standpoint, if the electric charge of the sun should remain undisturbed from year to year in view of the enormous activities which are taking place upon his surface.

It may require much time to learn the magnitude and nature of the solar electric forces, but it is readily conceivable that a globe of such dimensions insulated in space might develop an electric charge which would be enormous by comparison with any that we are capable of measuring or observing on the surface of the earth, and at the bottom of its atmospheric ocean. Even the earth on which we live might, as a mass, be the seat of an enormous electrification relatively to other planetary bodies without our being in any way rendered cognizant of the fact. What seems, however, to be particularly noticeable in the suggestions of Thomson, Lodge and Fitzgerald, is that the behavior of the enormously big is capable of being explained by electrical conditions postulated for the almost inconceivably small. In other words, it would seem that the explanation not merely of solar coronal streamers, terrestrial magnetic storms, auroræ, and allied phenomena, may be accounted for on the recently created electron theory; but, also, perhaps, the more fundamental phenomena of mass-inertia and universal gravitation.

According to the electron theory, it would seem that all electric conduction currents in matter are due to the motion of electrons or ions or minute sub-atomic particles of matter in their natural electrified state. A very small amount of such ionized matter can carry a relatively large amount of electricity. Electrostatic induction cur-

rents, such as occur in condensers when charged with alternating electromotive forces, or in the ether when traversed by light and Hertzian waves, are not due to the movement of ions, but to the elastic behavior of the medium under electric stress. A relatively small quantity of ionized matter in the cathode-ray state, projected from the sun into space, and impinging upon the earth dissymmetrically might, it is suggested, act as an irregular current sheet dissymmetrically enveloping the earth, and so give rise to magnetic disturbances; while the projection of ionized matter from the earth itself into space under solar cathodic-ray stimulus might, perhaps, account for auroral streamers.

The immediate danger of the future seems to lie in working a willing horse to death, and in trying to account for too much by the electron hypothesis, thereby deluding ourselves into the belief that matters are accounted for, and an aching void of knowledge filled which is only hidden from sight and temporarily veiled by ingenious hypotheses. But the electron theory does not seem to have met with any refutation thus far.

WIRELESS TELEGRAPHY.

From time to time we see published reports on wireless telegraphy of an exceedingly interesting, promising and uninstructive character, from which, however, we have vainly endeavored to extract a definite view of the situation. In order that we may stand acquitted of ultra-conservatism and of making light of important advances, we subjoin a few typical dispatches bearing on recent progress in the art, which summarize with substantial accuracy the sources of exact knowledge which have recently become available:

Exhibit I. "Prof. Jabez Q. Slowman, of Oshkosh University, has invented a new form of receiver for wireless telegraphy which is destined to supplant the costly and complicated apparatus of Marconi and his followers. It is contained in a common cigar box, and has a sensitiveness of no less than 100,000,000 watts. Pending the granting of the Professor's European patents, we are unable to describe the details of his marvelous apparatus by which messages can be sent from Oshkosh to London." Exhibit II. "Sig. Spaghetti, of the Royal Italian Marine Cavalry, has recently succeeded in demonstrating by novel apparatus of his own invention that the notions of wireless telegraphy hitherto held are based upon an entirely erroneous conception of the phenomena. He finds that the electric impulses are depolarized in the upper regions of the atmosphere, and hence instead of using the tall masts which have been responsible for so many failures, he employs a conductor extending vertically downward into the earth, thus utilizing the conducting central core of our planet. The Minister of War has ordered the distinguished inventor to Spezzia to continue his experiments." Exhibit III. "Lieut. Von Limburger has recently devised a new field wireless telegraph equipment of unequaled sensitiveness and power, constructed entirely of aluminium and weighing only 243.4 kilos. In the recent manœuvers it was successfully used between Wurstburg and Gansestein, a distance of more than 21 kilometres. Lieut. Limburger's invention has been adopted by the War Department, and the inventor has been decorated with the Order of the Green Parrot."

Our esteemed readers can find scores of similar exhibits, equally rich in corroborative detail, in the daily press, and can appreciate the interest with which we await further particulars. Meanwhile, in those corners of the world in which the wireless telegraph is really needed things appear to remain *in statu quo*. In pursuing our inquiries, we found that a number of wireless telegraph sets had been sent to the seat of war in South Africa, and had been successfully used in communicating between war ships sufficiently far removed from the firing line. Meanwhile the search for De Wet goes merrily on, and the only Boers found are discovered after the manner of carpet tacks on one's bedroom floor. It is all very interesting and instructive, of course, to learn that the wireless telegraph is at the front, but what is it doing there? Also in the Chinese campaign, we found that what little communication was established at all was due to the dexterity of the wideawake little Japanese in running telegraph wires. In the practical work of a campaign, the new method seems as yet to have found no place. We learn that our army authorities are doing some capital experimental work, but in spite of the work done nothing published here or elsewhere seems to indicate very startling success in the line of military communications. For special commercial purposes between fixed and not too distant bases the outlook seems rather better, but of definite achievements we hear but little. An exception to the rule should be made in the case of Prof. Fessenden's work for the Weather Bureau, which promises to result in the first real practical application of wireless telegraphy in this country to useful purposes.

HIGH-TENSION ALTERNATORS.

An article by M. Guilbert, continued in this issue, is interesting for the many points of comparison suggested between European and American alternators, as well as for suggestions concerning alternators generally from all parts of the world. Some of the differences between American and European practice are apparently merely incidental, while others are brought about by the imperative logic of local exigencies. Thus, as an illustration of the first point, in this country there are a large number of two-phase alternators, while in Europe two-phasers are comparatively rare.

The development of the alternator in the days when it was a belt-driven machine, was in the direction of very high speeds of rotation. When the size of the machine increased, the belt had to come off and the alternator had to be directly driven by the engine. This union necessitated considerable readjustment between the two components. The engine had to be speeded up as far as it could safely go, and the alternator had to be reduced in speed to match. The result is that most large engine-driven alternators turn more slowly than they would if their designer had a free hand to select their speed.

One of the main difficulties with alternators is their regulation, and a small drop of pressure at full non-inductive load, and particularly a small drop of pressure at full inductive load, is only obtained at considerable cost. If, however, automatically self-compounding machines can be constructed in large sizes we may expect a considerable reduction in the amount of copper employed in both field and armature. Several such plans have been tried with fair success on smaller sizes of machines, but no large alternators seem as yet to have been built that are automatically compounded for variation in the power factor as well as for variation in the load.

If the steam turbine proves successful in large sizes, as we all hope it may, the steam engine instead of being a laggard in speed, will be a runaway driver, and the opposite tendency will have to be met by designers in alternators with few poles, high speed and light construction. If the steam turbine is really successful in large sizes —and it gives every promise of being so—we may expect to see a rotary engine and direct-driven alternator occupying but little floor space and moving at high rotatory speeds with but very little vibration and less attention, with an output per pound of plant weight as small as that of alternator weight alone at the present time. In that case the locomotive engine might in time perhaps become the sole survivor of the reciprocating steam engine.

Death of Dr. Elisha Gray.

IT is with much regret that we announce the sudden death at Newtonville, Mass., on Jan. 21, of Dr. Elisha Gray, at the age of 66. He had been in Boston for some time past, pursuing his work in marine signaling and telephony with Mr. A. J. Mundy, and was visiting at Newtonville. On Sunday afternoon he complained of a chill, and consulted a doctor. He dropped dead on Monday, his complaint being stated as neuralgia of the heart. Only last week he was a visitor in New York, on Jan. 15, and spent the afternoon visiting the offices of the ELECTRICAL WORLD AND ENGINEER and the American Institute of Electrical Engineers. It was a very stormy day, and when remonstrated with for his recklessness in traveling around in such weather, he took it good naturedly, appealing to his robust appearance as proof of his powers of endurance, but saying he was extremely careful not to overtax his strength. Thus passes away a man who has long been in the forefront of American electrical invention and industry, and around whose work bids fair to breed a controversy not unlike that between the supporters of Morse and of Vail over the telegraph.

Dr. Gray was born at Barnesville, Ohio, on Aug. 2, 1835, and for many years of his early life he was a carpenter's apprentice, and learned blacksmithing and boat-building. He was even then a great student of natural science. At 21 he went to Oberlin College, and there pursued five years of work, mostly in physical science. At about his 30th year he became interested in electrical mechanism. His first invention was an automatic self-adjusting telegraphic relay. He followed this soon after with a telegraphic switch and annunciator for hotels, a private telegraph line printer, and a telegraphic repeater.

THE LATE DR. ELISHA GRAY.

With E. M. Barton he organized the firm of Gray & Barton, out of which sprang the Western Electric Company. During the years 1873-74-75 his attention was much absorbed in developing a system of so-called electro-harmonic telegraphy for transmitting sounds over the wires of the telegraph. The basis of this system was the discovery of the law of vibration by which a sound produced in the presence of a magnet will cause a magnet of similar adjustment to respond to its tone. Mr. Gray was led to his most valuable discoveries in this line by a domestic incident. In a paper before the American Electrical Society, of Chicago, on "Transmission of Musical Tones," read March 17, 1875, he says: "My nephew was playing with a small induction coil, taking shocks for the amusement of the younger children. He had connected one end of the secondary coil to the zinc lining of the bathtub, which was dry. Holding the other end of the coil in his left hand he touched the lining of the tub with the right. In making the contact his hand would glide along the side for a short distance. At these times I noticed a sound was proceeding from under his hand at the point of contact, having the same pitch and quality of the vibrating electrome. I immediately took the electrode in my hand, and, repeating the operation, found to my astonishment that by rubbing hard and rapidly I could make a much louder sound than the interrupter or electrome. I then changed the pitch of the vibrator and found that the pitch of the sound under my hand was also changed, agreeing with that of the vibrator."

On Feb. 14, 1876, Prof. Gray filed a caveat at Washington with the expectation of perfecting the "art of transmitting vocal sounds telegraphically." As is well known, contemporaneous workers in the same line were Prof. Dolbear and Prof. A. Graham Bell, the latter of whom, though possibly anticipated by Gray's caveat, was granted a broad patent for speaking telephones on March 8, 1876. Of late years there has been a fierce controversy entering at some stages into the telephone litigations, over an alleged betrayal in the United States Patent Office of Gray's caveat by an examiner named Wilbur to the Bell attorneys and to Prof. Bell himself, for a money consideration. Wilbur before his death backed and filled so often as to his affidavit that he had sold out, that not even the Government suit to invalidate the Bell patent for Patent Office laches could render him respectable or credible; but the story, it must be confessed, remains an article of faith with many, and had no more strenuous believer than Dr. Gray himself. It may be noted that Bell and Gray were given equal honors for the telephone at the Paris Exposition of 1889. One unfortunate thing that tended to increase Dr. Gray's soreness was the fact that in spite of his undoubted priority as a telephone inventor, he himself received little pecuniary reward. The Harmonic Telegraph Company, with the Gray inventions and claims, went into the possession of the Western Union Company, which, by conceding the Bell claims of the American Bell Telephone Company, by the famous contract of 1879, netted several million dollars during the life of the patents, without otherwise raising a finger. Dr. Gray has said that he never received personally a clear $100,000, and it galled him acutely to think that he was deprived of both proper fame and a fair pecuniary return, under circumstances which he believed to be deeply tainted with fraud. On this very point, in connection with the list of great electrical names of the last century, he lately wrote to the editors of this journal, as follows: "I should place Faraday first, especially for his discovery of magneto electricity. Henry second, because he made the work of Morse possible. Morse third, because, not so much as an inventor as a promoter of what has proven to be one of the greatest civilizing agencies of the nineteenth century. Lord Kelvin, because of his service to the science and to the world, especially in making ocean telegraphy a success. Helmholtz, not so much for his contributions to electrical as to science in general, especially his researches in acoustics which were of such value in leading up to the discovery of the underlying principles of the telephone, a discovery which in its results for civilization was the greatest one of the nineteenth century. It was a discovery rather than invention, as almost any kind of an electro-magnetic instrument would talk when once the fundamental principle was announced. This is why there were so many claimants; every inventor went to his scrap heap and some of them found apparatus that could be made to talk now that they had been taught how.

"In the matter of the telephone, I should first place the man at the head of the list who discovered first the principle and method of operation. It lies between Bell and myself. I first described it in my caveat. Bell first made it a few days after the filing of my description. I then gave it to him, because he first made it, but now I have evidence which convinces me *beyond a doubt* that I showed him how. The public does not know this as I do, and I, therefore, do not expect a verdict in my favor."

In addition to his work on the telephone, Dr. Gray spent much of his time in late years in the development of a telautograph system, which has been fully described and illustrated in these pages, and which exhibited his wonted inventive ability and ingenuity. Although the device has not gone yet into general use, he brought it to a high degree of practical utility. Within the past 18 months he had spent considerable time in Boston in the development of a system for signaling by bells, etc., with the aid of telephones, through water, at distances up to 12 miles. This work again has been very successful, and bids fair to be the basis of new lighthouse warnings and ship protection, as well as of use in naval operations.

Dr. Gray in 1893, in connection with the World's Fair at Chicago, was the organizing chairman of the International Electrical Congress of that year. Recently he published a popular book on electricity, the large sale of which was a cause of much gratification to him. In personal appearance, Dr. Gray was quite striking, and in any assemblage he would have been picked out as a notable personality, with his tall, sturdy figure, long white hair, overhanging brows and bright, keen eye. He was an agreeable companion and very cheery and humorous, except that in late years a feeling of having been hardly dealt by in the matter of the telephone seemed to hang over him like a cloud that he could not banish. He left a widow and a son.

Notes on Electric Light and Power Work at Butte, Mont.

By J. R. CRAVATH.

BUTTE, Mont., has a peculiar interest to electrical men as the home of the largest copper mine in the world, the Anaconda. It is also of interest as being one of the best markets for electric power in the Rocky Mountain district on account of the large number of copper, silver and lead mines and reduction mills, and the good demand for light that comes from a live and prosperous mining town. There is at present only one water-power plant, supplying the town, the balance of the electric power being supplied from steam plants at Butte. The Montana Power Transmission

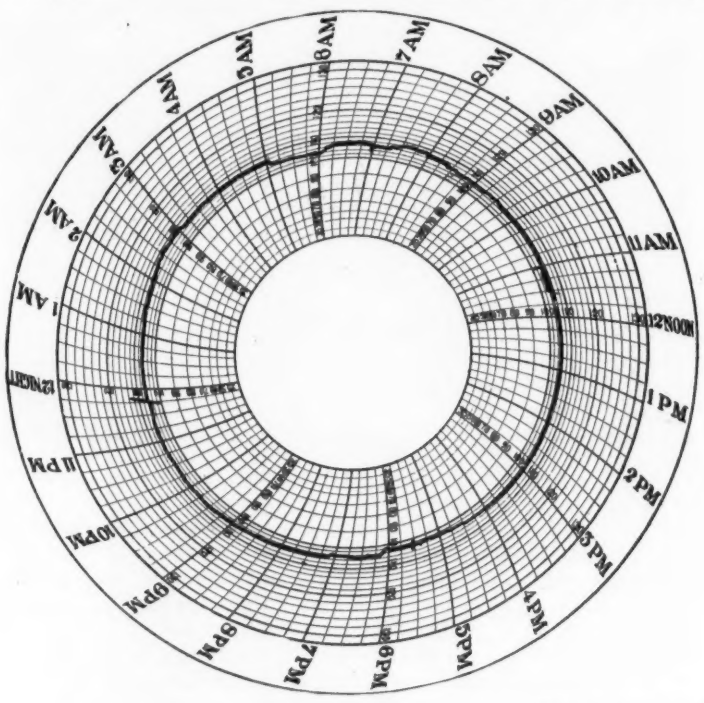
FIG. I.—LINE CROSSING CONTINENTAL DIVIDE.

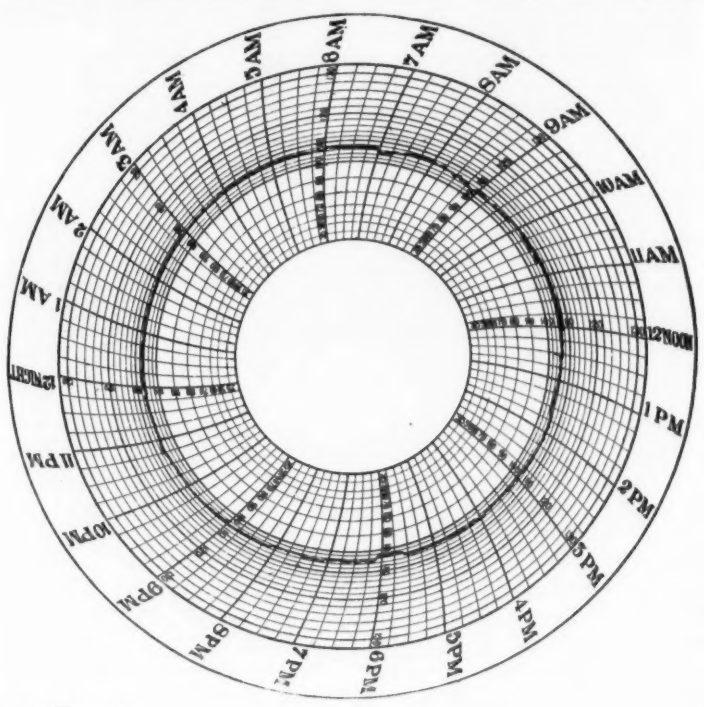
Company owns a water-power plant, on the Big Hole River, over 20 miles from Butte, and sells power to the Butte Lighting & Power Company. The transmission is at 16,000 volts. The sub-station in Butte also contains a steam plant, which supplies what power cannot be furnished by the water-power plant. Max Hebgen is in charge of the operation of both companies.

The 16,000-volt transmission line has been remarkably free from interruption. In the first year of operation, which ended Dec. 15, 1900, there was only one break in the service, and that was due to a very unusual occurrence. In blasting for a sewer in Butte, under the line, some rocks were blown up through the line and broke it down. The trouble experienced elsewhere from the shooting at insulators and throwing things across the lines by boys, has not been felt at Butte. This is no doubt because the line runs across an unpopulated district over low mountains. The line (see Fig. 1) has the distinction of crossing the great continental divide. The power is generated on the Atlantic slope, and used on the Pacific. The line consists of two three-phase circuits on porcelain insulators, on a six-pin cross arm, as shown in Fig. 1. Above the cross arm carrying the high-tension lines is a cross-arm carrying two barbed wires for lightning protection. A third barbed wire is put on a pin on the pole top. These are not fastened with staples, as is the common practice, but are on glass insulators just as any line wire. They are grounded every fifth pole and at streams. The object of putting the barbed wire on insulators is to prevent corrosion and breakage of the wire. The barbed wire has so far proved a very efficient protection against lightning, although in the country through which the line passes many trees are splintered from that cause. Although in service only one year, current was on the line two years preceding that to prevent wire being stolen and furnish light at the water-power plant from Butte during construction. There has been so little trouble on the transmission line that regular patroling has been abandoned. Leakages are made apparent from the sound of the telephone, and when the telephone indicates a leak men are sent out to fix it. The telephone line is on the same poles as the transmission line, as seen. There are no fuses in the 16,000-volt circuit or on the generators.

At the sub-station is also a steam-generating plant. The light and power distribution in Butte is made at 2200 volts, three-phase, and 500 volts direct-current. The lighting circuits were formerly on a single phase system, and when the change was made to three-phase the balancing of circuits was done by plugging various feeders onto the three-phase mains at the central station switchboard in such a way as to maintain the balance of the load on the circuits. The distribution of feeders to secure a more perfect balance can be changed at any time.

For power purposes, both induction and synchronous motors are used, and circuits separate from the lighting are run for this purpose. Most of these large three-phase motors are 2000-volt machines, run direct from the primary circuit. A large amount of power is also furnished by a 500-volt rotary converter. Synchronous motors have been intelligently placed on lines having induction motors, so that the power factor averages 87 per cent. The strength of the field excitation on these synchronous motors is adjusted by the company at the time the motors are installed, so as to give a leading current on the line whenever the capacity of the motor is large enough to permit this. These synchronous motors are mostly old, 125-cycle





FIGS. 2 AND 3.—VOLTAGE RECORDS.

single-phase alternators, rewound for 2000 volts three-phase, and are giving excellent service. In rewinding the armatures (which were all single-phase surface wound of various makes and sizes), they were slotted in a planer. For this cast core heads firmly clamped were, of course, necessary. The winding was done with formed coils, two coils per slot and two slots per phase per pole, or six slots per pole. The two adjacent coils of each phase were connected in series, and the three phases of the armature connected on the Y

method. The frequency being 60, these motors run about half their former speed as dynamos, which is more suitable for a motor than the former high speeds. The cost of this rewinding was only from $150 to $200 to a motor, and it seems to be an excellent way of making use of old material. Two of these synchronous motors are belted to old 500-volt generators for carrying the power load when

FIG. 4.—DAM AND POWER HOUSE.

the rotary needs to be stopped, so saving investment in one new rotary.

As mentioned before, the lighting feeders are balanced between the legs of the three-phase mains by a plug switchboard at the station. This includes constant-current alternating arcs. Each incandescent lighting feeder supplies one district. Each district is numbered, and where there is more than one transformer in a district they are run in parallel on the same secondary network. The secondaries are three-wire 105-210 volt.

The regulation on the system is remarkably good, as can be seen

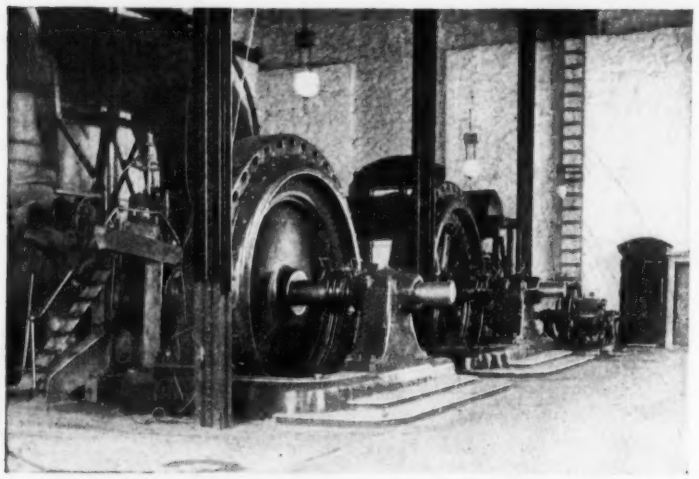


FIG. 5.—TWO GENERATORS AND TURBINES.

by the accompanying Bristol recording voltmeter charts, Figs. 2 and 3, from an instrument connected on the mains in the business part of town. Considering that a water-power plant is furnishing part of the power, and that during daylight hours, 75 per cent of the load is power which is fluctuating greatly, such a record may to some look like an impossibility. Mr. Hebgen lays much of the credit for the good regulation to heavy flywheel action. Lombard water-wheel governors are used, and their performance is excellent, but Mr. Hubgen considers good heavy flywheels in the shape of revolving field alternators as essential in damping the small pumping action of a governor, which pumping with a fluctuating load knocks out all attempts at close regulation. The water-wheel regulation is as good now as that on a first-class steam engine.

As mentioned before, there are no fuses either on the generators or high-tension lines. Oil switches are being put on the generators. This omission of all automatic-circuit opening devices is partly on account of the danger of temporarily shutting down the whole system by the blowing of fuses, and partly because it is not thought desirable or safe for the apparatus to suddenly open the main circuit. It is believed that as between a short circuit on one of these large alternators and a sudden open circuit that the short circuit is the least harmful. In case of short circuit these generators will give a little less than 50 per cent of their full-load current. In connection with this the question naturally arises, what about the strain on an alternator when it is being cut off the bus-bars and put out of service? In this company's plants this is being provided for by an attachment to the main circuit oil switch, whereby the alternator field current is cut down the instant the main armature circuit is opened.

The water-power plant on the Big Hole River, 21 miles from Butte, has four 750-kw, 60-cycle, 800-volt, revolving field three-phase alternators, driven by horizontal Niagara type Leffel turbines, running 180 r. p. m. The working head of water is 58 ft. The transformers, which step up from 800 to 16,000 volts, are General Electric air blast. Fig. 4 is a view of the dam and power house, Fig. 5 shows two of the generators and turbines, while Fig. 6 shows the storage reservoir above the dam.

As said before, the average power factor on the system for 24 hours is 87 per cent. Few plants of this kind have an accurate record of what their power factor is, and as this figure is not a guess, but is the result of actual tests by an interesting method, it is of value. The method of determining the power factor is this: The plant is operated in the ordinary way, and the ammeter and voltmeter readings are taken to give the apparent watts. Then one of the generators at the power house is started up and run as a synchonous motor. The field of this motor is over-excited so as to give a leading current. The effect of this is to overcome induction and bring the power factor up toward unity. The excitation is increased until the power factor is unity, which is indicated by the ammeter reaching its lowest position, on a given load. The observed watts will then be the true watts, and can be compared with the previous reading. At present writing, when the load is not too heavy to spare one generator, one generator is run as a synchronous motor with heavily excited field on purpose to bring the power factor near to unity. In this way the one idle generator at the power house takes care of

FIG. 6.—STORAGE RESERVOIR.

part of the idle current on the system, and the other generators are run fully loaded on useful current.

A systematic overhauling of all the meters on the line is being made with a view to cutting down the loss of revenue through meters running slow.

Canadian Water Power Development.

The Great Dog Falls, over which the drainage of 1200 square miles of territory passes, are to be developed into electrical power and the power transmitted to Port Arthur, Ont. The company which will develop the power has been quietly investigating the possibilities of these immense falls. The Ontario government will be interviewed with the object of securing control of the falls at once. The Great Dog Falls are, in an air line, about 25 miles from Port Arthur, and according to estimates, are capable of giving 5000 horsepower the year round.

The Washington, D. C., Electric Automobile Service.

WASHINGTON CITY, with a large influx of visitors who come to spend money seeing the sights, a population largely made up of wealthy people and high Government officials, and with streets of asphalt everywhere, offered exceptional inducements for just such an enterprise as the Washington Electric Vehicle Transportation Company, and the managers are to be congratulated upon the result and the outlook.

The work of securing a strong foothold was not an easy task, however. The investment in costly vehicles and apparatus was continued

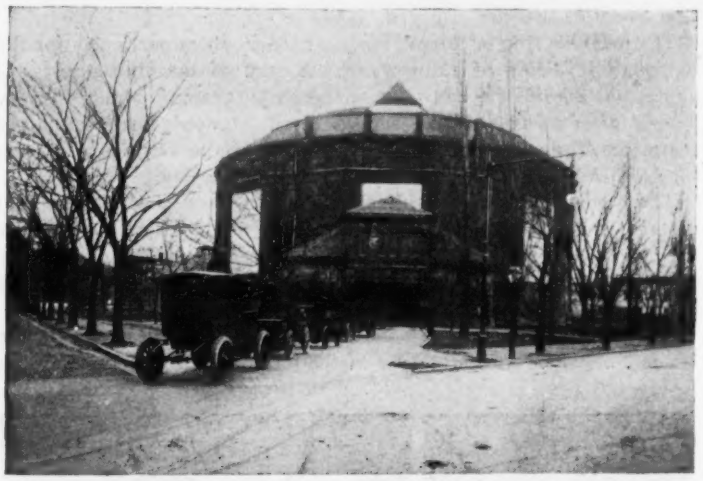


FIG. 1.—EXTERIOR OF AUTOMOBILE STATION.

at a pace just ahead of the returns from the services rendered to the public, so that to-day the parent company acknowledges this branch to be one of the finest and most thrifty that it has established. There are many reasons why this plant should be successfully and economically operated, and in brief they are as follows: The streets and avenues are paved with asphalt, the street railways use grooved rails flush with the roadbed, the climatic conditions are favorable, there being little snowfall, and what does fall as a rule melts quickly. The central station is in point of fact nearly centrally located with respect to the business portion of the city, the prominent hotels, theatres, public buildings and attractions for sight-seers. The grades in Washington are exceptionally easy, and in most cases the roads to points of interest near the city are under Government control and always kept in perfect condition.

The central station and offices of the company are located in the edifice known as the Panorama Building on Fifteenth Street and Ohio Avenue, three blocks south of the United States Treasury Building. (Fig. 1.)

At present, only the ground floor of the building is used, with the exception of a gallery for the drivers' lockers, shown in the right of Fig. 2. The 16-sided brick building is 100 ft. in diameter. The roof is about 80 ft from the floor. The walls of the building are sufficiently strong to easily sustain the weight of additional floors when loaded with vehicles. These floors will be built when the business has so increased that more storage room is required.

The offices of the several departments and waiting rooms for patrons are located at the street entrance. In the wings that have been added to the building since it was acquired by this company are the extensive machine shops, battery rooms, booster crushers and boilers for heating the building. The whole floor of the main building is paved with granolithic, sloped to drains at the centre. Around the sides the vehicles are arranged according to styles and service conditions.

Located near the centre is the apparatus for putting in and taking out of vehicles the trays of batteries. For vehicles having underslung batteries there is a specially constructed device located alongside of the other apparatus just mentioned. Batteries can be changed in three vehicles at one time. At present there are 120 vehicles in the livery service, consisting of hansoms, broughams, golf traps, surreys, four styles of victorias, runabouts, hotel busses, theatre busses and 15 broughams in the service of the Baltimore & Ohio Railroad.

A number of the diplomatic corps and society people have been carefully taught by experienced men to drive runabouts and victorias, and are permitted to hire these vehicles and use them at will, without the attendance of the company's drivers. The instructions given this highly privileged class of patrons, besides covering fully the handling of the vehicle, include information as to distances that can be traveled on a single charge of batteries, and at what readings of the measuring instruments it is wise to return to the central station for freshly charged batteries, which can be had at all hours, with a delay of a very few minutes.

A large number of vehicles are rented by the month and are delivered to and returned by drivers in livery. This service is subject to call at all hours of the day or night, and to as many calls as may be made. To facilitate the conduct of business there have been established several separate departments, all under the management of the

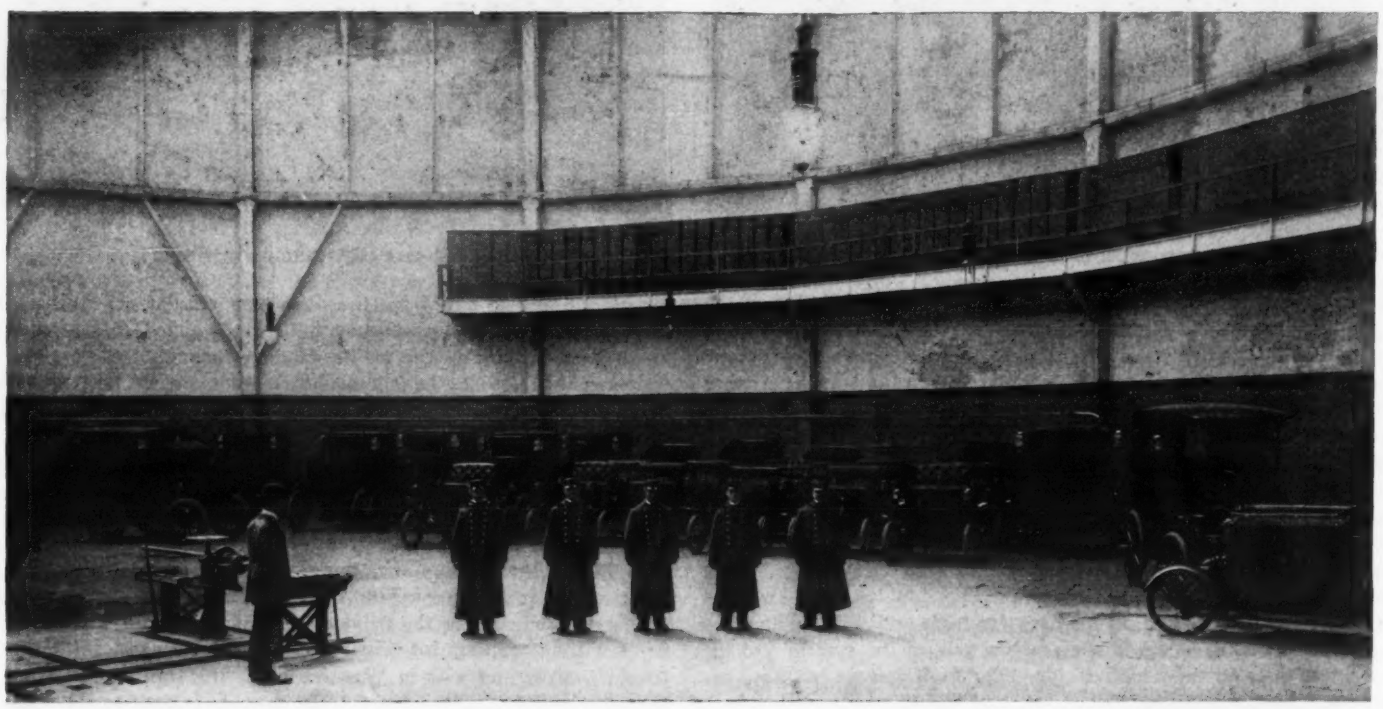


FIG. 2.—INTERIOR OF AUTOMOBILE STATION.

general superintendent, Mr. Wm. T. Headley, formerly of the New York system, who is assisted by the chief electrician, the master mechanic, and Mr. Alfred M. Welch, manager of the selling and renting department.

The chief electrician has charge of the electric installation, and under him are the switchboard men and the battery men. This de-

partment is the most important branch of the business and demands more than passing mention. Unusual conditions were encountered in the installation of the electrical service for charging the batteries, and it was found necessary to devise special electrical apparatus to insure a constant potential. The charging station being located within 1500 ft. of the local lighting and power station, two sets of cables were laid, one of 1,000,000 cir. mil. capacity and a reserve cable of 500,000 cir. mil. capacity, both running directly to the bus-bars of the main switchboard at the power house. This arrangement gave the full fluctuation in voltage at power house at the charging station also, and means for taking care of it were provided as follows: For transforming this very variable current to a constant potential a booster-crusher set was installed. This consists of a 50-hp motor directly connected to two generators each of a capacity of 450 amperes and 33 volts, with Belknap regulators of special design, connected in series with the fields of the two generators. With this apparatus a constant potential of 122 volts is maintained at the bus-bars of the charging switchboard and fluctuations in the primary potential of 33 volts above or below the normal can be taken care of automatically. When the initial voltage is above the normal, the motor acts as a generator, and the two generators act as motors, the outside wires of the three-wire system being

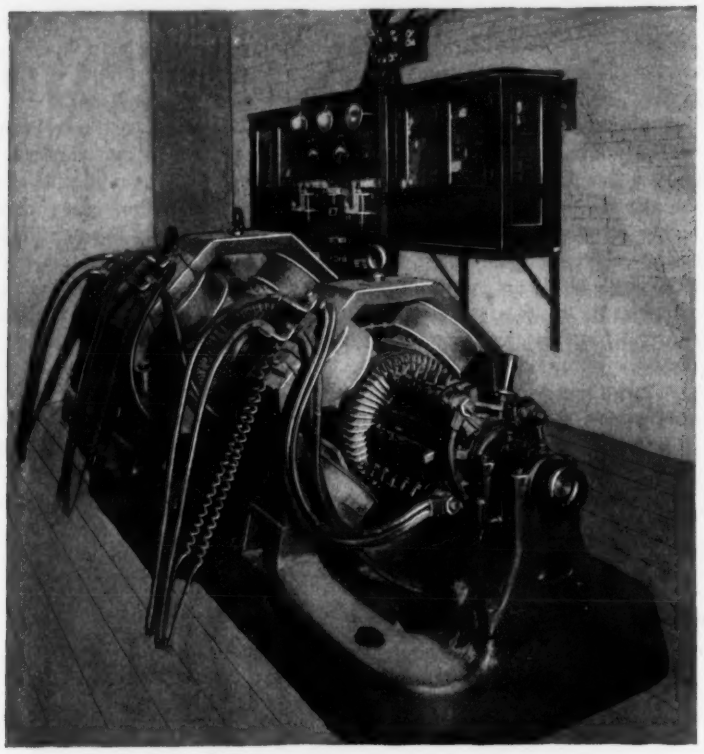


FIG. 3.—THE BOOSTER-CRUSHER AND SWITCHBOARD.

led through their armatures. When the initial voltage is below the normal, the reverse action takes place. When the initial voltage is normal the regulators stand at the neutral point, and not over one volt is generated. The current is then taken from the booster-crusher switchboard by cables to the charging switchboard, consisting of 18 panels, each with a capacity of 8 circuits. Each panel is equipped with 8 enclosed rheostats set edgewise at the lower part of the panel. Above, mounted on slate, are one Weston round-pattern 150-volt voltmeter, one Weston round-pattern 150-ampere ammeter, one 8-circuit voltmeter switch, one 8-circuit ammeter switch and eight 75-ampere single-pole double-throw knife switches set horizontally and having enclosed fuses at the two extremities. The double-throw switches are connected to two sets of bus-bars for high and low voltage, the four upper switches being on the positive side of the system and the four lower ones on the negative side. The high voltage bus-bars are connected to one booster-crusher set, and the low voltage bus-bars will be connected to another booster-crusher set (now being built), and which will be set at a lower voltage to be used in beginning the charging. The main cables are connected to double-throw switches, so that they can be connected through the booster-crushers, or direct to the street mains, and the charging rheostats are of a sufficient capacity to take care of a large range in the initial voltage, if the booster-crushers should ever break down. (Fig. 3.)

Individual circuits are carried overhead from the charging switchboard to the various parts of the battery room, the other side of the circuit being supplied from the neutral cable, which does not go through the switchboard. The current comes down through the twin cables into the charging plugs, receptacles being supplied on the various battery trucks. The switches on the switchboard are numbered correspondingly with the plugs, so that the switchboard men can at any time determine the exact condition of the battery attached to any plug in the charging room, of which there are 144. There are, in addition to these plugs, 16 plugs in the main building arranged for charging batteries without removing them from the vehicles containing them. The battery men test and repair batteries, see that they are properly placed in or taken from vehicles, and make up all the new batteries that are required. (Fig. 4.)

The machine ship is completely equipped in every particular for the thorough repairing of automobiles. A staff of machinists who are experts in automobile construction carefully examine at night every vehicle after its day's work, and make all the needed repairs or adjustments, thus insuring perfect condition of the vehicles whenever they are called into service.

The company has a considerable number of elegant vehicles that are rented to private parties for their own use. These vehicles are quartered at the station, where the drivers remain in charge of them, ready to respond with them at any hour. These drivers are in the special livery of the lessees of the vehicles.

The favorite vehicles for the monthly service are the victorias, broughams and runabouts. All of the prominent hotels have electric

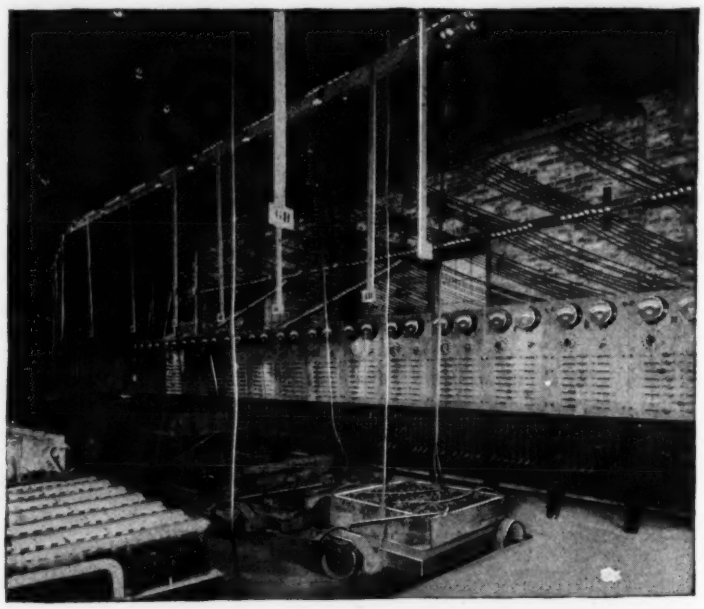


FIG. 4.—THE CHARGING SWITCHBOARD.

busses running to and from the depots on regular schedules. It is the truthful boast of the manager that these vehicles have never failed in meeting punctually the trains running through the city. In addition to this service, the leading hotels maintain electric cab service for the convenience of guests. All of these vehicles are operated by this company. The drivers are all carefully picked men and are put through a thorough course of training before they are finally accepted. They are uniformed and daily inspected for general appearance before they take a vehicle from the building. When the drivers meet with accidents to their vehicles, they report at once to the central station by telephone. Should nothing out of the ordinary occur, a report is made and posted for the future guidance of drivers, explaining the proper remedy for the trouble, enabling them to make minor repairs without calling for assistance from the central station. One trouble, rarely met with in Washington, is the stalling of vehicles in the snowbanks at street curbs. The trouble is now easily remedied by wrapping the tires of the drive wheels with a small rope. The rope gives the wheels a grip and prevents slipping and churning in one spot.

In the station office are a number of starters who keep the register in which all calls for vehicles are recorded, the kind of vehicle desired, the time it is wanted and the name and address of the person asking for service. The starters see that prompt service is rendered. There are two shifts of drivers, working 12 hours each. The day men

report on at 7 a. m. and off at 7 p. m.; the night men report on at 7 p. m. and off at 7 a. m.

In Washington the vehicles are allowed to run at a maximum speed of 12 miles per hour, but this is not always strictly obeyed. Accidents are rare to either vehicles or pedestrians. The service rendered

FIG 5.—FAVORITE AUTOMOBILE ROAD IN FRONT OF CAPITOL.

the public is excellent, and the public appreciation is abundantly proven by its great popularity.

The work on this station was designed and supervised by Mr. A. W. Gilbert, superintendent of construction for the Electric Vehicle Company of New York. The electrical part was carried out by the Electro-Dynamic Company of Philadelphia and the General Incandescent Arc Light Company of New York.

Niagara and the Pan-American

BY ORRIN E. DUNLAP.

Henry Rustin, chief of the mechanical and electrical bureau of the Pan-American Exposition, reports that he is confident that all of the electrical work will be completed in ample time for the opening of the Exposition on May 1. It will be recalled that the Pan-American Exposition is to receive 5000 electrical horse-power from Niagara Falls, a contract for that amount of force having been made with the Cataract Power & Conduit Company. This power will be generated in the central station of the Niagara Falls Power Company at a voltage of 2200, two-phase, and it will pass from the power station to the transformer station, where its voltage will be raised to 22,000, three-phase, for transmission to Buffalo. In the terminal station of the company on Niagara Street in Buffalo, the voltage will be reduced to 11,000, and at this potential it will be conducted over a special transmission line, for a distance of 13,000 ft., to the Exposition grounds. This transmission line leading from the terminal station to the grounds is an overhead line, and has six bare copper cables of 00 wire. The line enters the Exposition plot near Groat Street and Elmwood Avenue, and drops into the rheostat for dimming effects. Converging into three cables, copper, lead covered, 300,000 cm., it passes under ground to the Electricity Building, connection being made with the transformer-service station in the General Electric Company's exhibit in the Electricity Building. At this point the current is stepped-down to 1800 volts, and at this pressure it is sent about the grounds to the many distributing transformers, which again reduce it to 104 volts for use at the lamps.

The transformer plant of the Pan-American Exposition will consist of 18 air-blast transformers, General Electric, form I. It will be equipped with blowers operated by electric motors, and a complete set of oil switches operated pneumatically. Distribution will be effected by an exceedingly handsome line of switchboard panels, of blue Vermont marble, having silver trimmings. This plant will control the entire decorative lighting system throughout the Exposition grounds, and the plant will itself be one of the exhibits of the Exposition. Its location will be adjacent to the exhibit of the General Electric Company, which, those in charge of the Exposition state, will be the largest ever attempted by that company.

In addition to the above, there will be an auxiliary plant for patrol and other lighting purposes. The object of this plant will be to supply 500-volt and 110-volt service without resorting to the use of rotary transformers. It will care for the necessary all-night lighting for police purposes. The apparatus in it will be part of the exhibit of the Westinghouse Electric & Manufacturing Company, and will consist of one 60-cycle alternator, having a capacity of 180-kw; four power generators, 500-volt, d. c., capacity 225-kw each; two 110-kw, 110-volt, d. c. generators, and 15 Brush arc machines, the circuits from which, except the all-night lighting circuit, will run direct from the power plant to the Electricity Building, which is to be the principal point of distribution. In addition to this a 600-kw, 60-cycle alternator, located in the exhibit of the Westinghouse Electric & Manufacturing Company, will be devoted to the service of the midway concessionaires' and exhibitors' lights.

The Pan-American Exposition is destined to be memorable for Mr. Luther Stieringer's charming water and light effects. For this reason the pumping plant of the fountains is closely connected in its usefulness with the electrical installation. The pumping plant will be located in the court of the Machinery and Transportation Building. It will consist of 12 pumps, made by the P. H. & F. M. Roots Company, of Connersville, Ind. These pumps will have a capacity of 35,000 gallons of water per minute, and will be run by exhibit engines of the following makes: American Engine Company, Bound Brook, N. J.; Murray Iron Works, Burlington, Iowa; Lane & Bodley, Cincinnati, Ohio; Ames Iron Works, Oswego, N. Y.; Harrisburg Engine Company, Harrisburg, Pa.; Fitchburg Steam Engine Company, Fitchburg, Mass.; Watertown Engine Company, Watertown, N. Y., and by gas engines of these makes: Struthers, Wells & Co., Warren, Pa.; National Meter Company, New York; Bessemer Gas Engine Company, Grove City, Pa.; Marinette Iron Works Manufacturing Company, Marinette, Wis.; J. L. Alberger & Son, Buffalo, N. Y.

These engines will be belted to their respective pump units, and will be required to be in service each day during the Exposition from 10 a. m. to 11.15 p. m. They will serve the fountain displays at the Electric Tower basin, and also in the Court of Fountains basin, including the Fountain of Abundance. Water is to be taken from an intake located at the north end of the Court of Fountains basin, through a 48-in. rivetted suction pipe, and delivered by pumps through 16-in. and 20-in. pipes at a pressure of 110 lbs. per square inch to the various fountain orifices.

In the court of the Machinery and Transportation Building there will also be located four engine-generator units. Two of these will be supplied by the D'Olier Engine Company, of Erie, Pa., and will be used for serving the projector display that lights up the spectacular fountain in the Electric Tower basin. Another of these units, furnished by the Erie Ball Engine Company, a direct-connected unit, will furnish 110-volt, d. c. service for arc lights in the plant itself, and also for decorative incandescent lighting around the arcade which surrounds the court of the Machinery and Transportation Building. The other unit will also be a direct connected one, and will be supplied by the American Engine Company, of Bound Brook, N. J. It will be used for furnishing arc light for the Horticulture group, as well as providing current for a storage battery station near the Streets of Venice concession, the boats on which will all be operated electrically. These launches will probably have motors of from five to seven horse-power capacity, and will be an attractive feature of the Exposition.

Dominion Cable Inquiry.

It is learned in Ottawa that the Imperial Government will appoint a committee to inquire into the question of cable communication. The investigation will be a very comprehensive one, and will not only deal with the present cable services in British territory, and the rates charged, but also will ascertain if it is possible to establish new lines with advantage. The inquiry will begin in February.

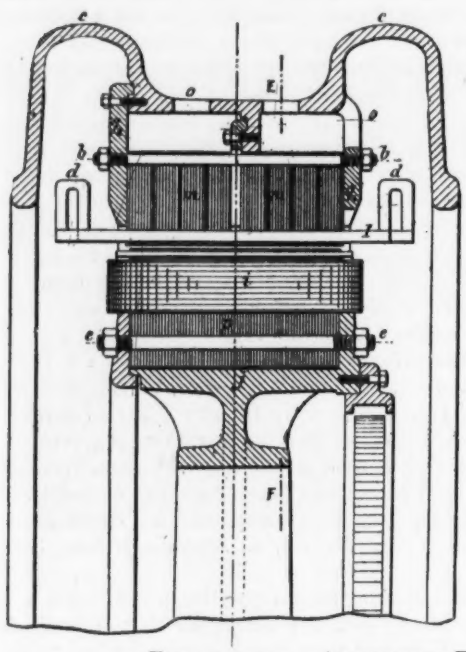
European Types of High-Tension Alternators—II.

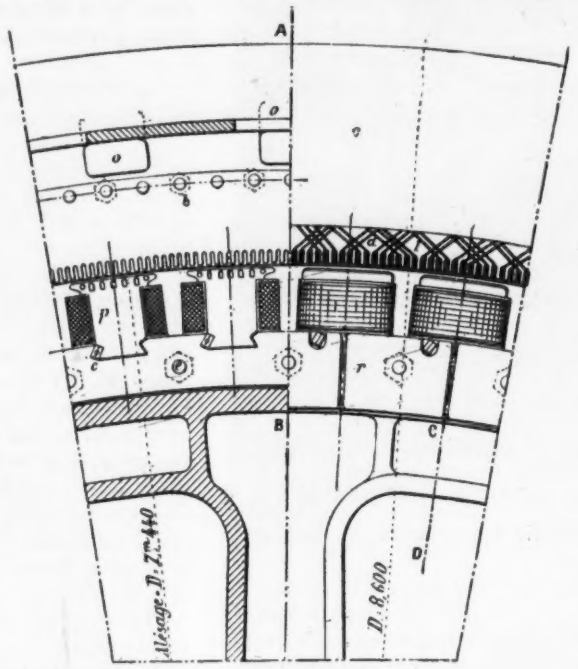
By C. F. Guilbert.

IN the descriptions which follow the order in which the various alternators are taken up will not be according to merit, but by countries, and in each country the machines will be classed by output, that of largest capacity coming first. The writer has not considered it advisable to follow order of merit, for his judgment has not in every case been in accord on this point with the report of the Exposition Jury, which, as may be easily understood, was not in every instance able to base judgment on technical consideratajons solely.

THREE-PHASE ALTERNATOR OF THE ALLGEMEINE ELEKTRICITATS GESELLSCHAFT.

The alternator exhibited in Paris by the Société Generale, of Berlin (Figs. 1 and 2), was the most powerful of the three-phase generators there shown. But one other machine was shown having the same rating, or 3000 kilovolt-amperes, that of the Helios Company. The latter machine, however, judging from the type of armature, appears to have been designed with a view to its eventual employment as a single-phase machine. It was built for one of the stations of the Berlin Electricity Works. The Oberspree and Moabit stations of this company will contain 22 machines of this type, of which 8 are now being installed, and 13 are under construction.





Figs. 1 and 2.—Allgemeine Elektricitats Gesellschaft Alternator.

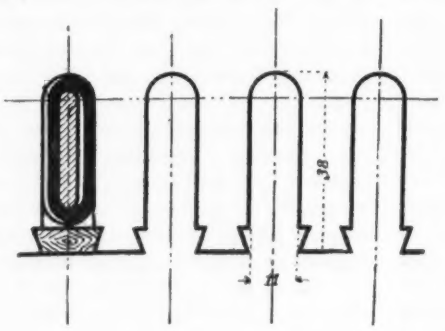
From the electrical standpoint, the Allgemeine alternator presents two principal features. One is the employment of Hutin and Leblanc amortisseur circuits, the patent for Germany on that device as well as all other patents of the inventors mentioned, being owned by the company manufacturing the machines. These circuits are for each pole formed of five bars of rectangular section and two of circular section placed at the horns of the poles. The seven bars are riveted to two copper segments placed on each side of the pole. The object of the amortisseur circuits is in this case to facilitate operation in parallel, and also to suppress harmonics in the armature flux, which otherwise would give rise to a rotary field having a speed of rotation with respect to the poles which would be greater the higher the order of the harmonics.

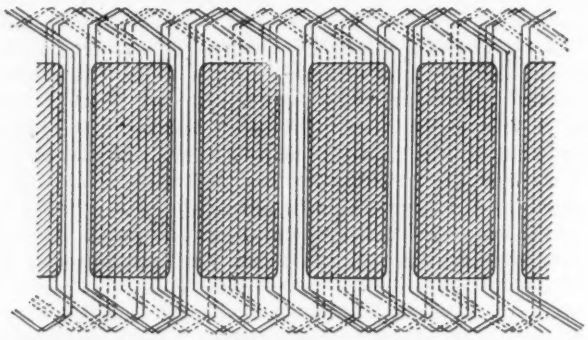
The second feature is the employment of bars with end connectors instead of coils, and with a number of slots per pole and per phase much greater than has been considered allowable in the case of alternators with fixed armatures. These bars (Fig. 3) are connected by means of end pieces having a V-section somewhat smaller than that of the bar, and placed in micanite tubes—the tubes being shown black in the engraving and the bars hatched—⅛-in. thickness. There are three different types of connectors with respect to length, as may be seen from the diagram of Fig. 4.

This diagram indicates that for each pair of poles, each of the phases of the armature winding includes a coil of three turns and one of two. The potential at the extremity of each conductor does not exceed nine to ten volts, and that between neighboring connectors never exceeds 20 volts, which explains why the latter are simply covered with a layer of insulating varnish, and why no attention has been given to insulating them with respect to the core. The generator terminals are mounted on porcelain insulators on the lower part of the dynamo frame.

HELIOS ALTERNATOR.

The alternator shown at Paris by the Société d'Electricite Helios (Figs. 5 and 6), had the highest normal output among the single and polyphase alternators in service at the Exposition, and it also had the largest diameter. The machine was operated by a direct connected horizontal triple-expansion engine. In point of fact, the machine was a single-phase alternator of 200 kilovolt-amperes, to which had been added, in order that it could furnish three-phase currents, an auxiliary winding mounted with respect to the main winding in a similar manner to the auxiliary winding of the Steinmetz monocyclic machine, but differing from the latter with respect to the ratio of the potentials of the auxiliary and principal windings. This ratio in the present case was that indicated by Scott—that is to say, $\sqrt{3}:2$ instead of 1:4. The capacity of the auxiliary winding was 1500 kilovolt-amperes, or 1910 volts and 788 amperes. The capacity of the machine as a three-phase generator for the same density of current in the armature as that in the auxiliary winding, should correspond to the same output of 788 amperes per phase; the single-phase potential being then 1270 volts, the apparent output is $3 \times 1270 \times 788 = 3000$ kilovolt-amperes. On the other hand, retaining the normal density of current in the two windings it can very simply be shown that the alternator would furnish at the same time an apparent output of 1200 kilovolt-amperes of single-phase current and an apparent output of 1500 kilovolt-amperes of three-phase current, the power factor being the same in each case.

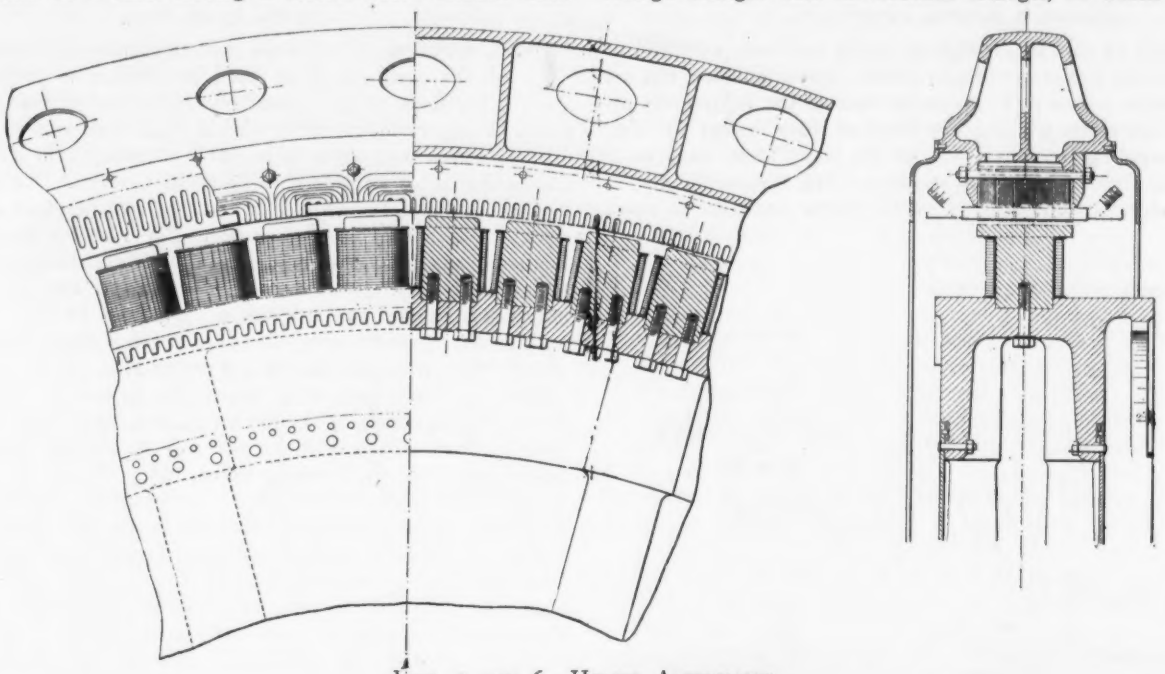




Figs. 3 and 4.—Section of Armature and Scheme of Winding.

The winding is disposed in 672 slots, or eight per pole. Of these eight slots, six carry the principal winding divided in three sections. The auxiliary winding consists of but a single coil per pair of poles, each of which consists of two sections. The 42 coils of this circuit are also grouped in three sections mounted in parallel. On account of the smaller current density in the auxiliary circuit, and conse-

quently of the smaller inductive drop in this circuit, the auxiliary winding consists of a cable having a section much smaller than that of the principal circuit. The difference of the inductive drop in the two circuits is due to the fact that in case of non-inductive loads, for example, equally distributed over the three legs of the line, the auxiliary circuit has a power factor of unity, while the two parts of the principal load have a power factor of .866 (cos. 30 degs.), as may be seen by laying down a voltage diagram.



FIGS. 5 AND 6.—HELIOS ALTERNATOR.

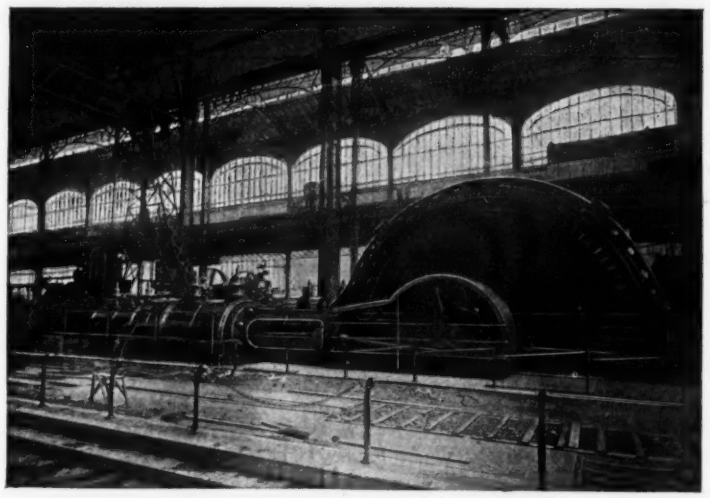


FIG. 6A.—HELIOS ALTERNATOR.

For inductive loads the case is similar. The largest ohmic drop permissible in the auxiliary winding permits of an equalization more or less exact of the drop in the two parts of the principal circuit. The dissymetry introduced by the simultaneous generation of simple and three-phase currents has for effect to replace the equilateral voltage triangle with an isosceles triangle, of which the base becomes smaller as the output of single-phase current becomes larger, the output of three-phase current remaining constant. It may be added that the dissymetry introduced by this system of winding is of the same order as that existing when three-phase alternators

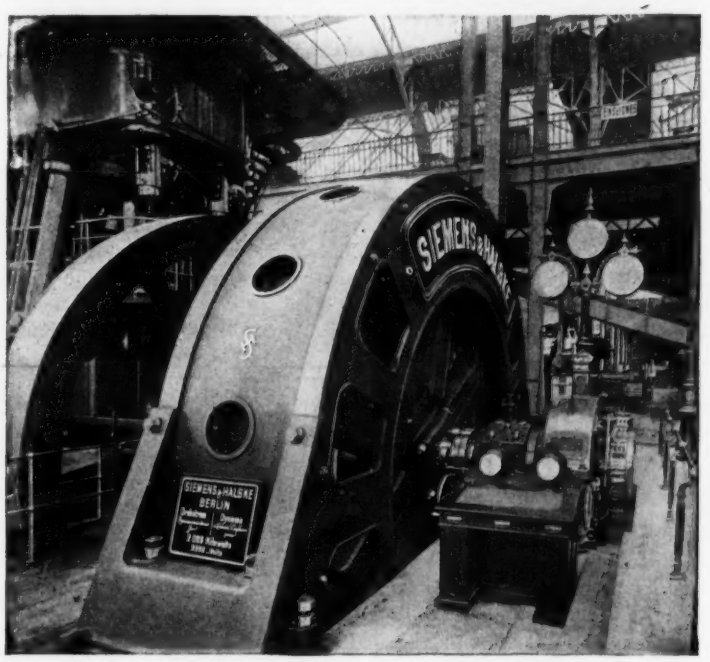
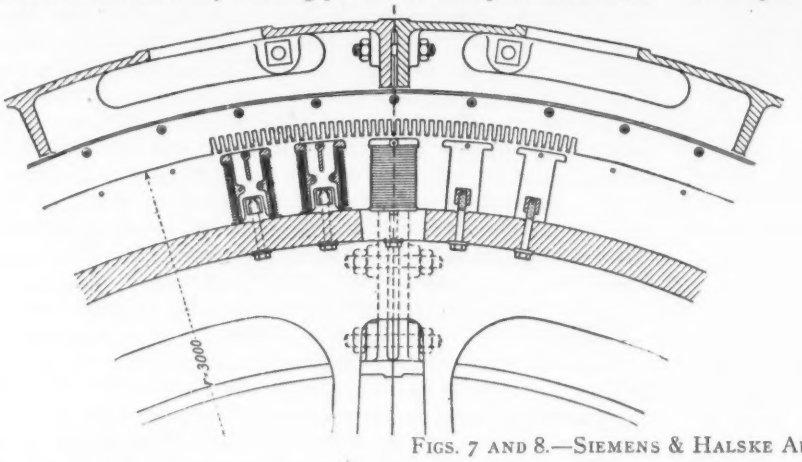
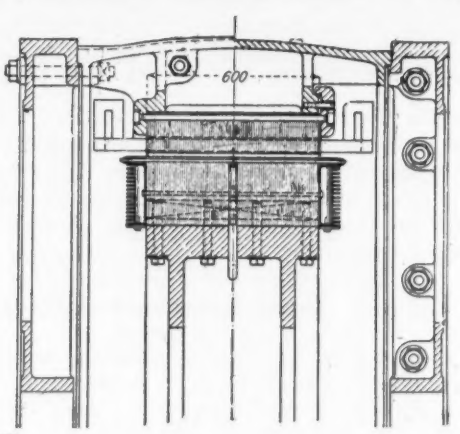


FIG. 8A.—SIEMENS & HALSKE ALTERNATOR.





FIGS. 7 AND 8.—SIEMENS & HALSKE ALTERNATOR.

operate on loads not equally distributed on the three phases of the line.

SIEMENS & HALSKE ALTERNATOR.

The alternator of this firm (Figs. 7, 8 and 9A), was operated at the Exposition by a Borsig four-cylinder triple-expansion engine, and provided with a flywheel. As in the case of the Allgemeine alternator, the armature winding consisted of bars united by connectors; the winding, however, was of the wave form, such as is employed with alternators of low tension. The measuring instruments—voltmeter, ammeter and wattmeter—were connected to small

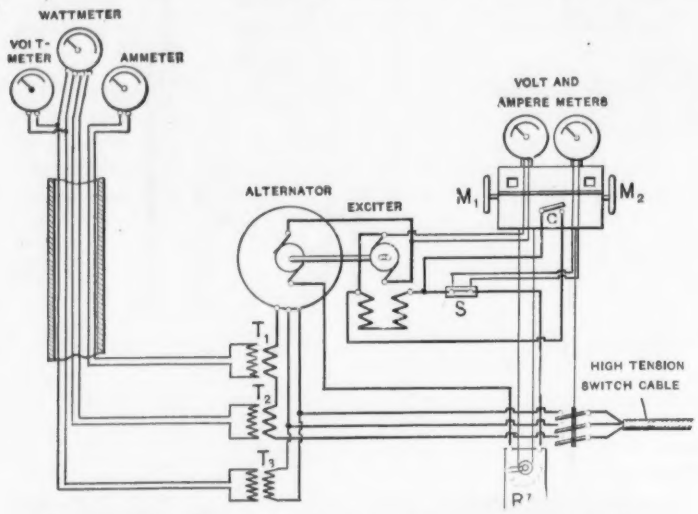
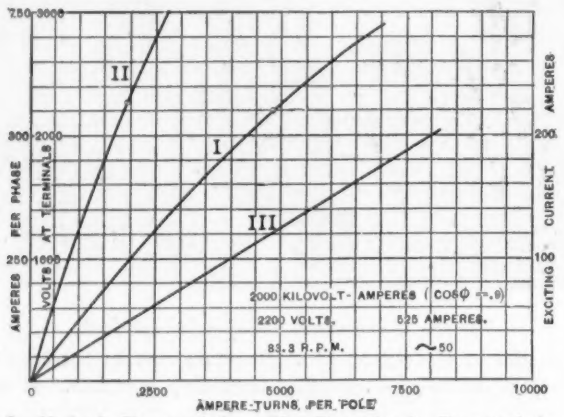


FIG. 9.—SIEMENS & HALSKE ARRANGEMENT OF INSTRUMENTS.

transformers; that for the voltmeter and for the fine wire coil of the alternator being on two legs of the circuit, and those for the ammeter and for the large wire coil of the wattmeter in series in one of the legs. Fig. 9 illustrates the arrangement.

In order to adjust the air-gap in case of its change through wearing of the bearings or other cause, the armature or stator was made perfectly cylindrical in a lathe, and bore on two rollers placed symmetrically with respect to a vertical plane passing through the shaft of the dynamo. These rollers may be adjusted vertically by means of a screw turned by a lever. If the two rollers are raised simul-



I.—No-load Characteristic. II.—Short-circuit Characteristic. III.—Excitation line.

FIG. 9A.—CHARACTERISTICS OF SIEMENS & HALSKE ALTERNATOR.

taneously, the frame will be raised vertically; and by turning one screw in one sense and the other in the opposite sense, a horizontal adjustment may be obtained. In order to prevent any displacement on the rollers after adjustment, the frame is rigidly bolted after the air-gap has been regulated to castings on each side serving as the support for the frame.

Gong Crusade in Chicago.

A beginning has been made in Chicago to supplant the clanging gongs of public vehicles by more mellow chimes, a down-town firm which operates several automobiles being the first to make the change. The Municipal Art Association and the Anti-Noise League are interested in the matter, and it has been suggested that a crusade against gongs be inaugurated.

Elements of Illumination—XIX.

BY DR. LOUIS BELL.

THE variation of resistance with temperature in such substances as the rare earths as used by Nernst is truly prodigious. They seem really to pass from insulators to conductors. Even glass, in fact, conducts fairly well at high temperatures, although in all such cases conduction is probably electrolytic in its character, a fact which is of considerable practical moment. As developed by Nernst his filaments when cold have several hundred times the resistance which they have when hot. Fig. 1 shows graphically from Nernst's tests the way in which the specific resistance falls off as the temperature rises. From the somewhat meagre data it is of necessity only approximate, but it gives a vivid idea of the extraordinary nature of the phenomenon. Of course, carbon shows a great decrease of resistance when hot, but it is a pretty good conductor when cold, while the Nernst filament is practically an insulator in that condition. But the oxides of the Nernst filament are enormously more refractory than carbon, and can not only be carried to far higher incandescence without breaking down, but probably have, at least in some of the combinations used a rather more efficient distribution of energy in the spectrum than is the case with carbon.

But being an insulator at ordinary temperatures some means has to be taken to get current through the filament. It has long been known in a general way that magnesia and similar materials conduct at a high temperature, and both Le Roux and Jablochkoff had dabbled with the idea years ago. But Nernst took up the matter anew and in earnest. The lamp which he has produced consists essentially of a thin pencil of mixed oxides, forming the incandescent

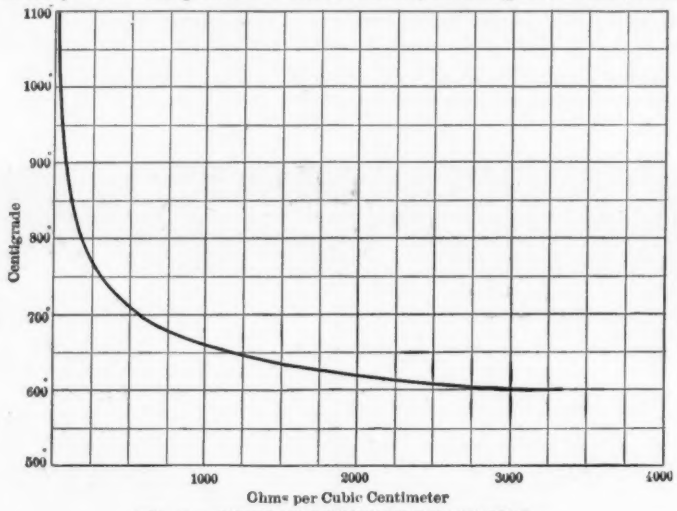
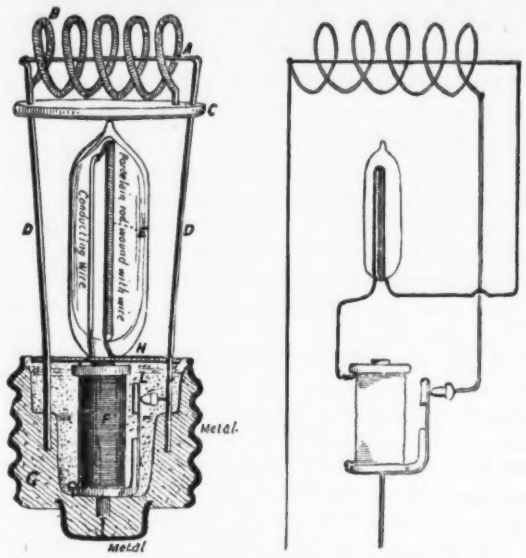


FIG. 1.—CURVE OF RESISTANCE VARIATION.

body. This pencil is much thicker and shorter than a carbon filament as used in incandescent lamps, being, say, from 1-64 to 1-16 in. in diameter, and ¾ to 1½ in. long. If heated by a match or spirit lamp the filament becomes a conductor, and goes to vivid incandescence. Such artificial heating being somewhat of a nuisance, much of the work spent in developing the Nernst lamp has been in the direction of providing means for artificial lighting. As developed abroad the self-lighting Nernst lamp has taken the form shown in Fig. 2. Rising from the base of the lamp *G* are two stiff wires, *DD*, spaced near the ends by a porcelain disk *C*. Across the platinum tips of these rods is fastened the filament *A*, secured at its terminals by conducting cement similar to that used in fastening incandescent lamp filaments. Coiled in loose turns about the filament is a porcelain spiral *B*, into the surface of which has been baked a fine platinum wire closely coiled around it. The office of this resistance spiral is to bring the filament to a temperature at which it begins to conduct. At the start *A* and *B* are in shunt, but when current gets fairly started through the former it energizes a tiny electro-magnet, *F*, situated in the base of the lamp, its armature *L* is attracted and the circuit through *B* broken, turning the whole current through *A*.

At *E* is a very interesting and important feature of the lamp. It is a resistance of fine iron wire wound upon a porcelain rod and sealed into a little bulb to prevent oxidation. It is connected in series with the filament. Now iron has a resistance that increases rapidly with the temperature, and this increase is particularly rapid at about 450 degs. to 500 degs. C. This resistance coil is designed so that with normal current in the lamp the temperature will rise to the point

noted, and its office is to steady the lamp. Without it the Nernst lamp would be terribly sensitive to variations in voltage, but if the voltage rises with this resistance in circuit, its increasing resistance chokes the current. Even with this steadying element the Nernst lamp is still hyper-sensitive to changes of voltage. The filament does not function properly in an exhausted globe, and must be worked in the free air, although a glass shade is provided to protect it from draughts, dust, etc. In point of fact, protection from draughts is at present rather necessary, since the filament is so sen-



FIGS. 2 AND 3.—CONNECTIONS OF NERNST LAMP.

sitive to changes in temperature that it can readily be blown out by the breath. Fig. 3 gives a clear idea of the connections of the lamp of Fig. 2, while Fig. 4 shows complete, on the left, one of the earlier Nernst lamps without the automatic lighting device.

The foreign manufacturers of these lamps are producing them of 25, 50 and 100 cp, for 110 and 220-volt circuits. It lends itself more readily to powerful high-voltage lamps than to small ones at low voltage, and is said to work better on alternating than on continuous-current circuits, apparently for reasons depending on the electrolytic nature of the conduction. Like other incandescent lamps, it works the more efficiently as the temperature rises, but owing to its refractory composition the Nernst filament can be pushed to very high efficiency. As the lamps are produced at the present time, their initial efficiency is about 1.50 to 1.75 watts per candle, including the energy lost in the steadying resistance (about 10 per cent), and the useful life is said to be about 300 hours. The filament at the end of this time rises in resistance and falls in efficiency, much like an ordinary incandescent filament.

The real life of a Nernst lamp, when defined as it should be in terms of, say a 20-per cent drop in candle power, is not at the present time known. It has only been put upon the market abroad within the present month, and the owners of the American rights have not yet put lamps on sale, so that really accurate data are entirely lacking as yet. It seems, however, certain that the Nernst lamp is an important addition to the art within at least a limited sphere. It gives a very powerful and steady white light at about double the efficiency of ordinary incandescents.

The present lighting arrangements seem altogether crude and imperfect, but it is probable that they will be displaced by something more simple and practical, as the art assumes definite shape. The filament can certainly be replaced at a trivial cost, far below the cost of replacement of an ordinary incandescent lamp, so that even with a rather short life of the filament, the lamp would still be economical in use. While less efficient than the best arc lamps it compares favorably with enclosed arcs of moderate amperage, and it is just now to be regarded rather as a competitor of the arc than of the glow lamp. However, it would take no great advance to change this condition, and the ease with which Nernst lamps may be made for high voltage is a rather important matter. If one institutes a comparison on the basis of 250-volt lamps the result is very greatly in favor of the Nernst filament at any reasonable estimate of its life. As in ordinary lamps so with Nernst lamps, filaments for small candle power involve unusual difficulties, but at present one may regard the 16-cp lamp as the normal glow lamp, while with the Nernst filament perhaps 50 cp may be regarded as the normal.

At present one must regard the Nernst lamp as in a tentative condition, and various problems regarding it must be threshed out—in particular there must be very radical improvement in the automatic lighting device or such evolution of a filament of some initial conductivity as will obviate further necessity for special lighting devices. But a higher efficient and very easily replaced incandescent body is in itself a material advantage over the delicate filament and exhausted globe of the ordinary incandescent lamp, and unless the former shall develop some unexpected limitation, it must be looked upon as a competitor that, although not now serious, may become so at any time, and to almost any extent.

Following up the question of higher luminous efficiency than that given by the incandescent lamp one naturally turns to the vacuum tube, in which the illuminant is not a heated solid, but an incandescent gas. It has long been well known that an electric discharge passed through a tube of very rarefied gas causes the tube to become the seat of very brilliant luminous phenomena. The light produced, however, does not form a continuous spectrum as does an incandescent solid, but gives a spectrum of bright bands or lines. This fact of itself gives some hope of efficiency, for it is the plentiful production of useless wave lengths that renders an ordinary incandescent body so inefficient a source of light. If a gas could be found giving a brilliant spectrum of bands, all of useful wave lengths, one might expect that a considerable proportion of the energy applied to the tube would turn up as illumination. Or if not a single gas, then a combination of gases might be found such as would answer the purpose. During the past ten years much work has been put in along this line by Mr. Tesla and others, but as yet without the production of a commercial lamp, although very magnificent effects have been produced experimentally.

The difficulties which have been met are first the need under ordinary conditions of rather high voltage in the discharge, the difficulty of obtaining a steady light of good color, and, most of all, the production of anything like a practicable intrinsic brilliancy. The brightness of an ordinary vacuum tube is apt to be greatly over-

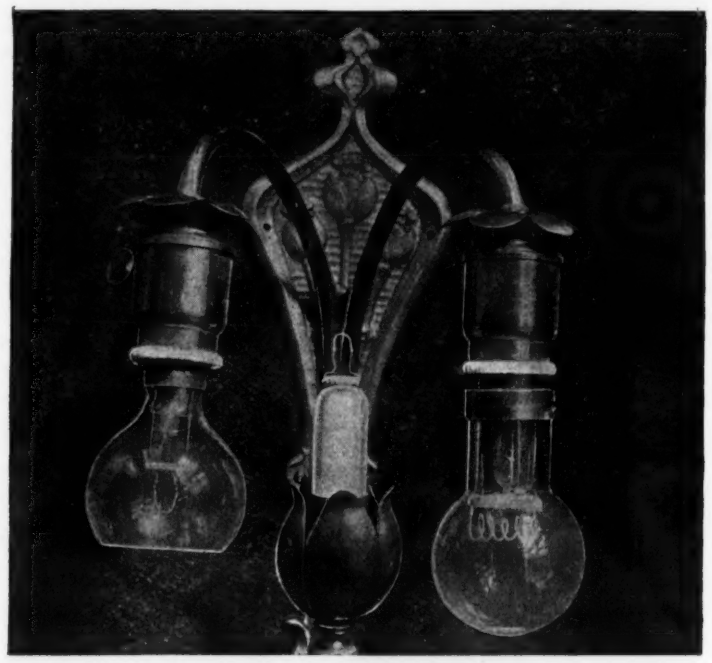


FIG. 4.—NERNST LAMPS.

rated, seen as it is with the room otherwise in darkness, and a tallow candle will make a pretty bright vacuum tube look like a wisp of fog.

Now, low intrinsic brilliancy is not in itself at all objectionable, but in the matter under discussion it connotes a radiant of large dimensions. This means that either there must be an enormous multiplicity of small tubes or else a few tubes so large as to involve pretty high electromotive force in driving the discharge through them. In either case, the condition is troublesome. In large tubes the light is generally very unsteady, and the best effects seem to be gotten from long-coiled tubes of small diameter, which are not easy to excite. As to color, there is a tendency toward a bluish hue, which will have to be removed before a practical lamp is produced. It is easy to find gaseous mixtures free from this objection, but perhaps at a considerable loss of efficiency.

The efficiency of the light produced by vacuum tubes has been several times measured, with fairly concordant results. It appears that the luminous efficiency, that is, the proportion of the whole radiant energy from the tube which is of luminous wave lengths, is something like 25 or 30 per cent, 5 or 6 times better than in case of the incandescent lamp.

If the tubes are forced to anything like the intrinsic brilliancy of even the dullest flames, secondary phenomena involving heating seem to arise, considerably decreasing the efficiency, so that it seems to be still a long step from our present vacuum tubes to "light without heat." This "light without heat" implies radiant energy that is nearly or quite all luminous. But this condition might be fulfilled and the light yet be most impractical, as, for example, in a sodium flame which gives an effect altogether ghastly. Any monochromatic light is utterly destructive of color, but it might be possible so to combine nearly monochromatic lights of the primary red, blue and green as to obviate this difficulty. Or, it may be eventually possible to excite luminous radiation in gases or even in solids so as to get results quite different from the ordinary spectra of the bodies. The vacuum tube lamp is certainly capable of development into a commercial method of illumination assuredly for some purposes, but in any form in which it has yet been suggested it must be regarded rather as a stepping stone on the way toward light without heat than as the thing itself. It is given this place in a discussion of practical illuminants not on account of its present position, but because the author is very strongly of the opinion that it may advance to some degree of importance at almost any moment, and gives promise of an efficiency considerably beyond anything which has hitherto been reached in artificial illuminants.

But it may be that we must look to the chemist rather than the electrician for the final word as to illumination. It is well within the bounds of possibility that some exaggerated phosphorescence may be found which will enable us to store solar energy directly for use at night. Or the firefly may give up his secret and teach us how to get light by chemical changes at low temperatures. And the firefly knows. The light emitted by such light-giving insects is unique and most extraordinary in its properties. For so far as can be ascertained the total radiant energy lies within the limits of the visible spectrum, and not only this but in the most brilliant part thereof. No similar distribution of radiant energy is elsewhere known. The ordinary firefly of this country is typical of the whole class, giving a greenish white light that when examined in the spectroscope shows a brilliant band extending over the yellow and green and fading rapidly as the red and blue are approached.

Prof. S. P. Langley has carefully investigated the radiation from *Pyrophorus noctilucus*, a West Indian species which attains a length of 1½ in., and of which a half dozen specimens in a bottle give light enough for reading. These insects gave spectra bright enough to permit careful investigation, and by comparison with solar light reduced to the same intensity, Langley found the curves shown in Fig. 5. Here *B* is the light radiated by the insect and *A* solar light. The curves show by the ordinates at each point the relative intensities of the various parts of the spectra. It at once appears that the light of *Pyrophorus* includes much the less range of color, and is much the richer in yellow and green. The maximum intensity is very near the beginning of the clear green (at about wave length 5500), and the light extends only a little way into the red and the blue. Fig. 5, which shows the apparent distribution of light indicated by the two curves exhibits the narrow limits of the radiation from *Pyrophorus* very clearly. The spectrum is practically limited by the solar lines *C* and *F*, and Langley's most careful experiments showed nothing perceptible outside of these limits, a most remarkable state of affairs, quite standing alone in our knowledge of radiation. For equal light Langley found that *Pyrophorus* expends only about 1-400 of the energy required by a candle or gas flame. This fact gives us a clue to the efficiency of *Pyrophorus* as a light producer. It appears to be about 0.20 watts per candle, perhaps even a little better—15 or 20 times the efficiency of an incandescent lamp, about five times the efficiency of an arc lamp at its very best. It is a startling lesson. The light-giving process of *Pyrophorus* is apparently the slow oxidation of some substance produced by it. Even if this substance could be reproduced in the laboratory the light would be too nearly monochromatic to be satisfactory as an illuminant, but it certainly is within the range of possibility to obtain a combination of phosphorescent substance that would give light of better color at very high efficiency. Certainly the problem is a most fascinating one, and whether the ultimate solution lies in vacuum-tube lighting or in some form of phosphorescence, one may say with an approach to certainty that all forms of incandescence of highly heated solids are too inefficient in giving light to approach the economy desirable in an artificial illuminant. Indeed, a solid substance of great light-giving efficiency when heated to incandescence would be somewhat of an anomaly, since it would have to possess an enormous specific heat at moderate temperatures. What is really needed is some method, chemical or electrical, passing by the slow vibrations that characterize radiant heat and stirring up directly vibrations of the frequency corresponding to light. The vacuum tube gives the nearest approach to a solution of this problem yet devised, but it still leaves much to be desired, and there is plenty of work for the investigator.

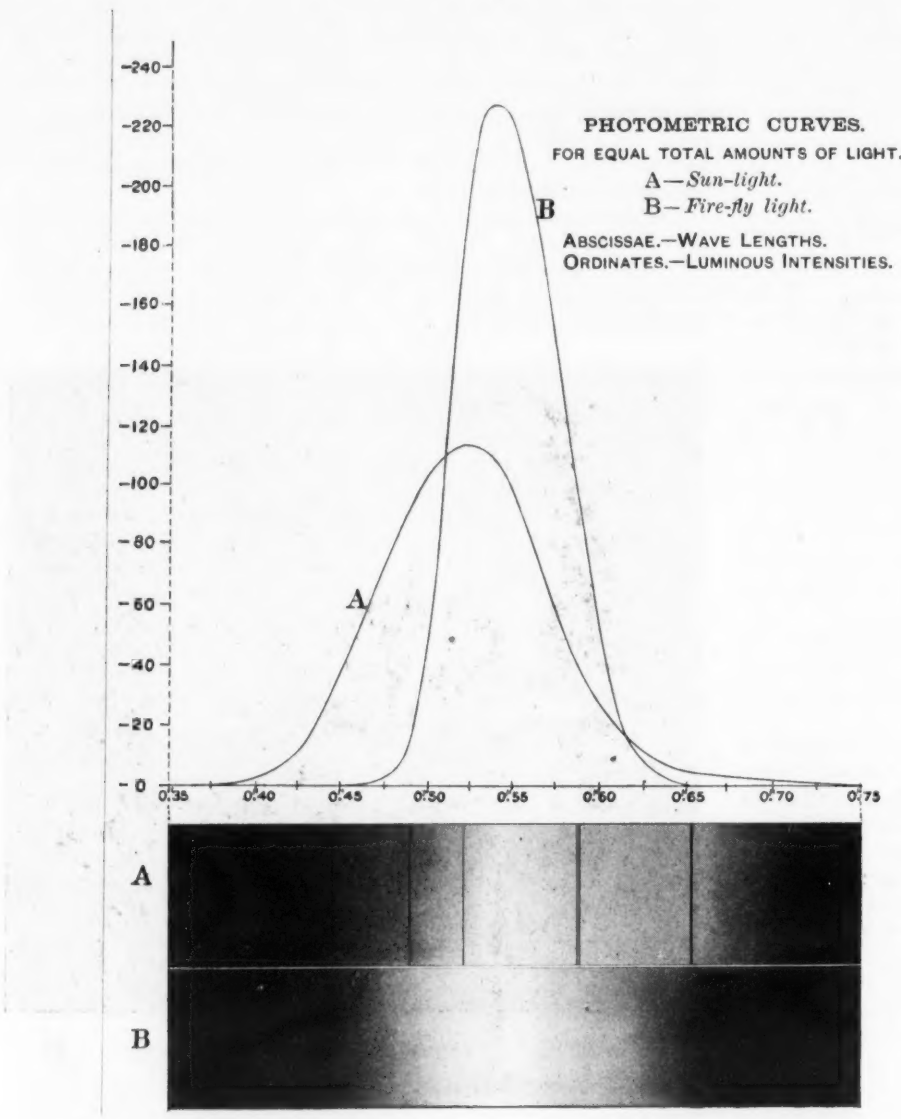


FIG. 5.—CURVES OF FIREFLY LIGHT AND SOLAR LIGHT.

Convention of the Northwestern Electrical Association.

THE sixth annual convention of the Northwestern Electrical Association was held at Milwaukee, Wis., on Wednesday and Thursday, Jan. 16 and 17. Five papers were presented before the meeting, and while the discussions were not as complete as usual, this is partly to be ascribed to the large amount of time consumed in the consideration of legislation in Wisconsin affecting the electric lighting interests of that State, and in a lengthy discussion on competition from gasoline lighting, which latter is abstracted below.

After considerable discussion as to whether the summer meeting of the association should be held in Madison or Sheboygan, the latter place was named, the time of meeting to be the last week in June, unless changed by the committee having power in the matter.

The following officers were elected for the ensuing year:

E. L. Debell, president; S. B. Livermore, first vice-president; W. Worth Bean, second vice-president; Thomas R. Mercein, secretary and treasurer. Directors: L. E. Kerns, J. H. Harding and Charles Cuno.

The address of the president, Mr. Pliny Norcross, was devoted to municipal ownership, and formed an able presentation of the subject from the central station point of view. The address is reprinted in another column.

Mr. P. D. Wagoner read a paper entitled "The Series Incandescent Lighting System of the Future," a considerable portion of which was devoted to a consideration of the Welsbach light. The result of tests were given on 14 80-cp (rated) Welsbach street mantles, made with a view of determining their photometric value and life. The average life of the mantles was 388 hours, and the illuminating power for that time averaged from 66.3 to 54 cp; 1.85 chimneys were required per mantle, so that 18 mantles would be required per year of 4000 hours. While the average of the candle-power when the mantles broke was 54, the useful life on the basis of the time in which the light falls to 80 per cent of the rated candle-power, was only 72.1 hours. It should be added that the tests on these mantles were made under laboratory conditions and were, therefore, more favorable than if made under actual working conditions. Tests of the useful illuminating power were also made in comparison with 50-cp incandescent lamps. A given size of type could be read 150 ft. from the 50-cp incandescent lamp, and only 122 ft. from the 60-cp Welsbach lamp.

A list is given of companies, located chiefly in New England, which have replied to inquiries regarding series incandescent systems. The candle-power of lamps used averages about 25, and the price varies from $15 to $20 per lamp per year, with an average of $16 for lights burning on moonlight schedule until 1 o'clock, and between $20 and $30 per lamp per year, with an average of $24 for lamps burning all night every night. The stations in general reported good satisfaction obtained from this class of illumination and a reasonable amount of profit.

Several systems of series incandescent lighting were described, and preference given to that employing an automatic constant-current transformer similar to that used for series arc lighting. As an example of the efficiency of this device, it is stated that one giving 100 per cent regulation on a 3000-volt, 3.5-ampere, 60-cycle circuit, has only 131 watts copper loss and no core loss when the circuit is fully loaded. When all the lamps on the circuit are cut out the total loss is 133 watts copper and 130 watts core loss. The power factor at full load is 98.5 per cent. The apparatus weighs approximately 400 lbs., occupies a floor space of 20 × 44 ft., and is 46 ft. high. The coils can be wound for any current, and when purchasing, if allowance is made for increased capacity for the future, practically nothing is lost by so doing, the regulator taking care of the load as it increases. If at any time it is desirable to install a number of lamps greater than the number which the line voltage will accommodate, this can be done with the same regulator by putting in a compensator to boost the voltage. A list accompanying the paper shows that this system is now in use, or has been ordered, for 26 towns and cities. It is stated that a further development of this type of apparatus will soon be placed on the market, in which both the boosting and regulating will be accomplished in one piece of apparatus.

In the discussion of Mr. Wagoner's paper, Mr. C. F. Hewitt said that the plant of which he has charge operates about 50 60-cp series incandescent lamps on the system described by Mr. Wagoner, which enabled his company to enter into fierce competition with Welsbach, gasoline and acetylene lights, including a new form of naphtha lamp, all of which were beaten out; the income of the station was increased $9,000 or $10,000 a year, and a load placed on the plant during the whole night. In reply to a question, Mr. Wagoner said: "It is practicable to operate the series incandescent lamps on the same circuit with enclosed alternating current arc lamps, using a constant-current transformer, which is being done at Woburn, Mass., and more or less on a number of other plants." In reply to a question asking if it could not be arranged to have taps added to the regulator, thus keeping the power factor up, Mr. Wagoner said that if the disadvantage of the power factor is considered greater than the extra cost of purchasing a constant potential compensator with taps, the reactive coil should by all means be run in conjunction with the compensator.

In a paper entitled "Synchronous Converters," Prof. W. E. Goldsborough gave a description of the rotary converter in simple language, enabling those not having an extensive knowledge of alternating currents to easily understand. The explanation of the apparatus was largely made with reference to the dynamotor, or direct-current converter, having two independent armature windings, whereby one direct-current voltage may be converted into another. A table was given, showing the different comparative capacity ratios of different types of single-current converters, as follows:

	Direct Current.	Single Phase.	Three Phase.	Four (Two) Phase.
Volts between adjacent collector rings.	1	.707	.612	.5
Amperes per line	1	1.414	.944	.707
Ratio of copper loss in rotary converter to copper loss of same machine operated as a direct-current generator at same output	1	1.37	.555	.37
Relative capacity of rotary converter, and same machine operated as a direct-current generator at same temperature	1	.85	1.34	1.64

The above consonants were derived mathematically, and assume a harmonic variation of voltage and current, and including no allowance in the voltage ratio for the copper losses in the winding. In practice, a variation of as much as 15 per cent may be found in these values, owing to departures from the sine waves, though the difference is not often more than 5 per cent. Rotary converters constructed for low efficiencies differ in but slight details from lines followed in the construction of standard direct-current machinery. For successful working it is necessary that the synchronous converter be equipped with an armature having high inductance. This means that the coils are placed in deep slots and the teeth with projecting heads are not objectionable. Machines with small armature self-induction do not compound so readily, and are prone to "hunt." The starting current of a rotary converter often exceeds by 50 and even 100 per cent the full load running current of the machine, which is likely to produce serious voltage fluctuations in the distributing system. Auto-transformers are consequently often used in starting, reducing the line voltage and consequently the starting current, and can be cut out when the speed of the machine has risen an appreciable amount.

In the discussion of Prof. Goldsborough's paper, Mr. Gill said that he had found trouble in the cables of his rotary converter, which ran very hot with 800 amperes, and that he could not account for the trouble. Prof. Goldsborough said that he could only account for the heating in a measure. The alternating currents themselves developed a magnetic field around the current which tends to repel the current to the outside layers of the wire, which increases the density in the copper at that point, and, therefore, increases the heating of the cable. Again, if the wave form of the generator were different from the wave form of the converter there would be idle currents circulating between the two machines to fill in the gaps of the wave forms, and thus cause heating of the cables. Prof. Jackson called attention to the fact that the power factor of the rotary converter in practice can never reach unity.

A paper on "Practical Line Construction," by Mr. Loren W. Burch, gave specific instructions for constructing electric-light lines. Throughout the paper Mr. Burch insisted upon the importance of good line construction, and the greater expense in the end of cheap lines. He believes that instead of trimming trees and thus causing annoyance to both property owners and the station managers, it is preferable to use high poles and carry the line above the trees. He also considers that stringing wires on buildings is bad practice.

In the discussion of Mr. Burch's paper, Mr. George Cutter referred to a recommendation that all guy wires should be fitted with

circuit breakers placed at a distance of 6 to 8 ft. from the pole end, and the grounding of all live guy wires. He said that two instances had come under his own observation where men had been killed by contact with guy wires, and he thought that every guy wire that is within the reach of the public should be perfectly grounded and insulated at the top.

Among the letters received was one from ex-President H. L. Doherty, who was unable to attend the convention. Mr. Doherty expressed the hope that the Association would give the question of Correspondence Instruction serious consideration, and stated the belief that the average central station could make enormous savings in boiler results alone by proper attempt to educate their station employees. He suggested that the Association can at the present time advantageously consider three-phase distribution for light and power, which is fast coming into public favor. Its use permits of many advantages which do not always appear on the surface, and this is especially so where there are immediate prospects of being forced underground, a fate which Mr. Doherty considers will have to be met by all sooner or later.

A letter of inquiry from an electrical company led to a lengthy discussion, which brought out the fact that in certain Western localities a gasoline street lighting system is being brought into competition with the electric light. One of the members described the system as consisting of a single Welsbach burner or a group of Welsbach burners fed from a gasoline holder, and others referred to a system in which the gasoline is conducted to the lamps in small tubes having the appearance of wires. The lamps are suspended much the same way as are arc lamps. A blow torch or alcohol lamp is needed to start up the lamps. One of the members stated that the burner referred to is known as the "Kern" burner, and that it is being pushed very hard.

Mr, Debell said that according to experiences had with the gasoline burner in Sheboygan, and judging from inquiries made in other places, it does not seem to promise to be much of a factor as a competitor with electric light. One of the strong objections to the light is the strong odor of gasoline which it gives forth, and unless some very radical improvement is made in this respect, the electric light need have little fear of the lamp for interior illumination. Mr. Livermore called attention to the fact that while the insurance laws require the merchant who deals in gasoline to keep his bulk gasoline outside of the building, the gasoline lamp is permitted to be used indoors, although in some of these lamps one-half gallon of gasoline is used, and the fluid is also distributed through thin tubing. Mr. Lord said that several years ago a gasoline-lighting plant was installed in his town, but on the third night after it had been running it exploded, and there had been no gasoline plant in Waupaca since. Mr. Kountz gave his experience with competition from the gasoline lamp, and said that as a result he is not afraid of any gasoline lamp that has been put on the market. Mr. Cutter said that in Chicago he found that gasoline lamps were being manufactured by the thousand, and he considers that they present a matter of danger for electric light people. Mr. Thayer said that gasoline made from Wyoming, California and Texas oils is not satisfactory, for the reason that in burning a black gum forms, which will, in the course of time, gum up the passage way. If the increase in the use of gasoline grows to any great extent, the price of gasoline will also increase. As Eastern oils contains but 10 per cent gasoline, it is thus practically a by-product, and its supply thus is limited. Mr. Grover said that recently in his town three fires were caused by gasoline lamps. Mr. Strong stated that an ordinary 62-cp gasoline lamp will run 125 hours on a quart of oil. Mr. Kountz said that he had had experience in competition with both gasoline and acetylene gas, and expressed the opinion that an electric-light plant properly operated and giving reasonably good service that cannot run in opposition to acetylene or the gasoline lamp, ought to go out of business.

Prof. D. C. Jackson read a report of the committee of the association on "The Trade Education of Central Station Employees." The report gives results of an investigation of the committee into four of the leading correspondence schools of the United States, to each of which a series of questions was submitted and an examination made of the financial status and administration of the schools correspondence instruction as being an excellent one in its place. It believes that good is coming from the correspondence schools, and is satisfied that the administrative methods are reasonably well planned. It considers, however, that the courses in electric lighting and central station practice of the schools must be greatly altered before they will be of the greatest use to central station employees, and through them to their employers, and the committee outlined a course which it believes would meet the requirements of the average central employee, and which would result in great advantage to central stations if the employees followed it. The course suggested is to be submitted to the central correspondence schools with the request that they change their courses as far as possible in order to conform with that suggested.

After reading his paper, Prof. Jackson added that after fully investigating the several correspondence schools mentioned he finds that each is financially responsible. Mr. Livermore said that the general tendency of correspondence schools was to elevate the men, and that he knows of several cases where men have moved rapidly up from lower to higher positions by the aid of these schools. Mr. Ahlmert stated that he took the lesson leaves of the correspondence schools and gave them to his employees, and once a week all through the winter gave a little lecture and went over the leaves with the men. The result was that he got very much better work from his men, but he has only one of them left, and he has been advanced in his position. The others have all found better positions elsewhere. He stated, however, that the results he obtained while he had the men with him amply repaid him for the trouble he took, and that he will continue along the same lines. A motion was finally adopted that the four leading correspondence schools of the country be individually requested to reorganize their course for central station employees to conform as nearly as possible with the requirements set forth in the report of the Northwestern Electrical Association.

A paper by Past-President Henry L. Doherty was read on "A Method of Charging," in which he gave further information concerning a system which was the subject of a paper read by him before the last meeting of the National Electric Light Association. In the system described there is a fixed charge for each consumer regardless of his consumption or the size of his installation, to cover certain costs, such as bill making and meter reading, meter testing and maintenance, office rent, superintendence and inspection, complaints and gratuitous work. There is also a fixed charge for each lamp the consumer's connection will permit him to demand, without regard to the number of lamps installed or amount of current used; this covering costs which are fixed by the capacity demanded, such as interest on the investment, transformer losses, maintenance, depreciation, etc. There is also a fixed and uniform rate per kw-hour consumed which is fixed by the direct cost of the current generated, in which enter boiler fuel, lamp renewals, etc. The total charge thus consists of one for "Readiness to Serve" and a low kw-hour rate. It is not advised, however, to suddenly change the rate, but to proceed by a gradual process. It is suggested to adopt the system first as a substitute for all special rate consumers and also for new consumers. Instead of dividing expenses as they exist to-day, and proportioning them among their consumers on the basis above outlined, it is well at starting to make such changes as will benefit long-hour, and, therefore, profitable consumers to such an extent as can be readily compensated for by the additional business which can be secured by a low rate per kw-hour. Mr. Doherty advised that all contracts be made for a year or more, the capacity to be increased whenever the consumer desires, but not to be decreased except at the expiration of the period contracted for; the capacity to be limited by a suitable maximum demand cut-out to prevent the consumer from demanding more capacity than he contracts and pays for. One-twelfth of the fixed charge should be included in each monthly bill. In conclusion, Mr. Doherty said the system is already in use in one central station with which he is connected, and that he is about to put it in use in two others. The system has also been partially adopted by other central stations with which he has no connection.

Municipal Ownership.

Following is an abstract of the presidential address of Mr. Pliny Norcross, delivered before the recent meeting of the Northwestern Electrical Association:

The fourteenth annual report of the Commissioners of Labor includes data from 952 plants in the United States, of which 320 are owned by municipalities, while 632 are operated under private or corporate ownership. Neither the names nor locations of these plants are given, but each plant is reported by a certain number. The report itself includes about 1000 pages of carefully prepared matter, and was suggested by a committee of the National Association of Officials of

Bureaus of Labor Statistics in the United States, consisting of Mr. Lee Merriweather, Commissioner of Labor of Missouri; Mr. Horace G. Wadlin Chief of the Bureau of Statistics of Labor of Massachusetts, and the president of the Convention—the United States Commissioner of Labor.

A study of this report develops many interesting facts. In one municipal plant, No. 151, there were 8 private arc lamps, 1200 cp, and 10 public street lamps. The users of the 8 private arc lamps were obliged to pay the city 12 cents a kilowatt hour, while the city paid nothing for its 10 street lamps. In other words, a few enterprising citizens paid for their own light 5 or 6 times as much as they would have paid to a private company, and they alone, thereby, carried the burden of lighting the streets, which should have been borne by all of the taxpayers.

In No. 152 the private user was compelled to pay 6 cents per kw-hour for 8 arc lamps, and $1 apiece for 2 other lamps, while the city reports that for its 26 arc lamps it pays but 2⅓ cents a kw-hour. In No. 156 it costs the city 5¾ cents a kw-hour for 42 street arc lamps. In this town or city there seems to be no private user willing to bear the burden of lighting the city.

In No. 160 it costs the city over 12½ cents a kw-hour to light 75 street lamps. In No. 161 a private company furnishes the city and private users light at the uniform and moderate price of 2½ cents a kw-hour. In No. 163, 15 private arc lamp users pay the city plant a little over 9 cents a kw-hour, and thus enjoy the honor of supplying the city with 14 street lamps free of cost to all other residents. In No. 165 there seems to be no public-spirited citizens who take arc lamps, and thus the cost to the city is over 3 cents a kw-hour. In No. 167 the city owns and operates the plant and furnishes arc lamps to 17 private users at 4½ cents, and admits a cost to itself for 50 arc lamps of over 11 6-10 cents per kw-hour. It is barely possible that the private users are public officers.

In No. 168 a private company gets between 8 cents and 12 cents from private users and receives from the city about 8½ cents. In No. 174 a municipal plant furnishes incandescent lamps for 8 cents a kw-hour, and thereby gets its own lamps for nothing. In No. 175 the same policy is pursued by a municipality, the private users alone paying for city lighting. In No. 179 the city furnishes 1050 incandescent lamps for 10 cents a kw-hour, and thereby gets its 24 arc lamps for a trifle less than 1 cent a kw-hour.

In Nos. 187 and 188 it costs the city $.0461 and $.0347, respectively. No private users. These samples are taken from one or two pages as they run.

The book, or report, is very interesting, and it establishes the fact that a city is not as well equipped to perform the intricate work of making and selling electric current as a private company which makes this class of work a close, careful study, for the sole purpose of furnishing to all customers reliable light, or power, or both, at a fair price, and at a very small profit to itself.

In cases of municipal ownership the city pays no direct tax on its plant, but indirectly it does pay a tax, because it does not receive the tax which a private company would pay into the treasury.

Ordinarily, a municipal plant makes no allowance for depreciation or for the exchange of improved appliances for the old system.

A city cannot buy material any cheaper than a private company, and usually not so cheaply; generally it pays more wages for inferior service. It is handicapped in the matter of adopting improvements.

In the matter of personal damage suits, a city occupies an unfortunate position. A city is not so well situated for speedy recovery from damage by freshets, cyclones or fire, as a private company.

Not long ago a Texas city gave bonds for over $1,500,000 for the construction of an immense dam and power plant, in the belief and hope that it could not only light its streets and public buildings for nothing by selling current to private consumers, but could secure a large profit thereby. It is a matter of record that the dam when built would not hold water, and utterly failed to furnish power for the use of the city alone. The enormous burden thus placed upon the city has reduced the price of real estate and discouraged investment.

Numerous instances can be readily cited to sustain the proposition that although the theory of municipal ownership is very bright and full of promise, yet the actual practice as shown by the majority of cases is not encouraging. Aside from figures and details, there is, to my mind, one insurmountable obstacle to city ownership and continued successful operation of electric plants:

All city officers must be elected by the people at large; as a rule, they never have been, and probably never will be elected for their fitness to discharge the various duties which they so willingly assume.

I readily concede that in many instances they are intelligent, honest, public-spirited men, and if they could remain in office long enough, and could afford to give up their own business and would devote their energy and time to the city business, they would soon become competent to perform the duties incident to their positions.

The whole matter of streets, sidewalks, gutters, sewers, parks, bridges, pavements, schools, courts, police, sanitary regulations, water and light supply, etc., is in most instances entirely new to them.

They are nominated and elected by their friends, and when elected they must take care of their friends, and that fact alone prevents such a discharge of their duties as they themselves would desire; but outside of those who are honest and intelligent, a great many are nominated for the sole reason that they can be elected when nominated. The same clique or "pull" which nominated them, also elects them. There is no pretense that they are capable, and there is no thought or care as to their honesty. If their record is a little shaky on that score, all the better for the purpose of those who secured their election.

When elected they must help their friends; but whether honest or dishonest, capable or incapable, most of them have had no experience in the work which comes to them when once in office. Their terms of office are short and uncertain; they generally receive no pay for their work; they are blamed and abused by the press or a part of it, and by a good part of those who elected them, and by all who opposed them. No sensible business man would for one week trust his business to such control or management.

The "fad" of municipal ownership of electric plants may sweep over the country as other socialistic, communistic, impracticable schemes have done, but it will in the end be a ruinous experience, and I firmly believe that there is not now so strong a sentiment in its favor as there was a year ago.

As the matter of municipal ownership is more fully understood the desire for it will diminish. One reason for its adoption by many towns is the fact that unpleasant relations have grown up between the local plant and the munipicality. The citizens are possessed with the idea that the local company is making too much money out of the business, while the company is confronted with the fact that the original outlay was not always a judicious one, and in all cases was very expensive.

I well remember the time when carbons, dynamos, lamps, etc., cost three times as much as they do now. In every case the original plant was too small, and people who first invested were glad enough to get out of it at any sacrifice. Most of the plants in operation to-day stand upon the ruins of one or two earlier plants.

The competing gas companies at first were somewhat disturbed by the new illuminant, and cut prices in order to hold their plants in operation. New electrical inventions then, as well as now, have compelled the abandonment of the earlier equipment.

Cities are besieged with applications, for apparently better contracts, and too often forced the old companies which had struggled bravely to hold up against the rising tide, into bankruptcy. The city often gave franchises to new companies, or still worse, practically confiscated the existing plant by putting in one of its own. In this way many of the pioneer plants proved to be unfortunate investments. Most of these unfortunate facts could have been prevented by a little mutual concession.

We are now called up in the matter of taxation. Many persons believe that none of the existing corporations are paying their proper proportion of the public expense. We cannot speak for others, but we believe that electric corporations are paying more than their share. The city insists upon getting the very lowest figure for its own service, in streets and public buildings, under the threat of municipal ownership, or, of permitting outside competitors to sweep away the local investment—then after getting the very lowest figure, proceeds deliberately to give the local electric company another twist, by raising the taxes from 50 to 100 per cent.

I sincerely believe that all of this unpleasant condition could be very much improved, if the State and municipality would adopt a new method of procedure. Instead of treating us as enemies to the public welfare, we should be treated as men who are engaged in the laudable effort of endeavoring to promote and enlarge one of the most useful industries known in the history of civilization. Treat us fairly, remember that the road which we have traveled for the last 15 years is literally strewn with the wrecks of hundreds of failures.

Almost all other corporations, such as railroads, telegraphs, telephone companies, water companies, gas companies, have passed through the trying years of experiment and disaster, and are now

standing on firm financial grounds. Their bonds are listed in all the market quotations of the world, and their stocks have a definite value; while our stocks and bonds are, in the main, unquoted and unsalable.

I would suggest as one way of reaching a better and fairer understanding between the local companies and the municipalities and States, that we promptly and honestly open our books to the inspection of the new Board of Taxation in this State, or to an inspector of that board, if such an officer should be appointed in that board, as recommended by our present Governor, in his recent address to our Legislature. Such action on our part would certainly give us the right to ask that our taxes should bear a proper relation to the salable value of our plants, and to our net earnings, and would in a large degree settle the question of whether or not the price of our product was reasonable, and would have a tendency to satisfy our own customers, including the cities where we individually operate, that we were treating them fairly. It would further give us the right to insist that the present Board of Tax Commissioners should not name a percentage or license fee at any arbitrary figure, until the Commission has fully examined the facts in each case.

Fifteen years ago an electric plant was considered an experimental, dangerous luxury. To-day it is an established fact that such a plant is one of the most necessary, useful and practical equipments of any city, town or village. It furnishes not only a cheap, safe and healthful light, which, of itself, is a most valuable assistant in preventing crime and securing good order, but it furnishes power at a low price for the local grain elevator, or grist mill, creamery, factory, woodyard or water tank, as well as for the dentist, blacksmith or sewing girl. It will cool the dwelling, office or hotel in summer time, and when connected with the hot water or steam system, it will heat the same in winter.

It puts the town or village in close companionship with the adjacent city by means of the suburban road. It is utilizing every water power on the face of the globe, thereby adding millions of horsepower, which since the creation has remained dormant. Instead of being opposed in its onward march and made the victim of unreasonable competition and of constantly increased taxation, it should be encouraged and sustained.

The practice of confiscating such a plant, or compelling it to produce current at less than cost, and continually and persistently raising its tax, makes it a precarious business and prevents improvement.

The matter of depreciation (which with us is a very serious one), the price of fuel and the freight thereon, vary almost 100 per cent in different parts of the Northwestern States; the price charged for our products, the wages paid, etc., tend to make the gross earnings of an electric plant an unjust standard of assessment. Yet, it may be the only method to adopt.

I would suggest further that the Board of Tax Commissioners recommend a sample of uniform books for our business. Then, after we have fairly done our part, in the matter of furnishing to all our patrons good light and reliable power, we want the State as well as the municipality, to stand by us and not confiscate our property or ruin us by unjust competition. Competition cannot reduce cost; it takes from the poor and weak, and gives to the rich and strong. No city or State should use it as a club to ruin its own citizens or taxpayers.

We must eventually pay our bonds, and our stock ought to be worth par. We must pay interest on our bonds, and we should be able to pay fair dividends on our stock. We must allow more for depreciation than any other of the public industries, and we should be allowed to put aside a reasonable surplus for disaster and for the replacement of present equipment for improved equipment.

If the State and municipality would be fair toward us, we should in a short time possess electric industries which would combine the superior attention, care, economy and experience of the private company, with public inspection and oversight, which, in my judgment, would be an almost perfect system. It would secure fair prices, good products, and would be a bulwark against failure or bankruptcy.

New Chinese Cable.

The Commercial Cable Company announces that in concert with the Great Northern Telegraph Company, and the Eastern Extension Australasia & China Telegraph Company a cable has been laid for the German Government between Tsingtan and Shanghai. The opening for international service took place on the 1st of January.

A Canadian Rival of Tesla and Marconi.

Prof. E. S. Wiggins, of Ottawa, Canada, has just published a disquisition upon the subject of Tesla's experiments to establish telephonic communication with the planet Mars, in which the former makes a startling assertion in regard to Marconi's discovery, and expresses strong disbelief concerning Tesla's claim of having mechanical and electrical devices by which electrical energy can be forced through space. Prof. Wiggins, however, considered it quite possible for the earth to have electrical communication with Mars, but deprecates the idea of forcing a current of electricity from the earth to Mars. Electricity, he claims, exists only on the surface of bodies. The surface of our own planet's atmosphere is covered by a lake of electrical energy, and no little current, such as Tesla describes, could pass through it without being absorbed.

"Communication with Mars can be established," Prof. Wiggins proceeds, "by Marconi's method, which I discovered and published in 1893, two years before Marconi began his experiments. That is, by elevated points on the same body or planet or different planets. Remove all our mountains but the highest peak. Upon this place an electrical instrument and it will affect a similar one on Mars, especially if the sun, earth and Mars are in conjunction. I am almost certain that, with a proper instrument on the summit of Mount St. Elias we could even now telegraph to the planet Mars. The nick in the edge of that planet, seen by Lowell and Javelle, July 19, 1894, was no doubt an enormous pinnacle, erected to communicate with the planets Jupiter and Saturn."

Speaking upon the question of his claim that Marconi founded his system on the published theory of Prof. Wiggins, and the latter's purpose to demand his right in the honor and emoluments accruing from the new discovery, the professor says: "Surely the philosopher, who by years of study evolves a theory, should be equally rewarded with the man who puts it to the practical test, by having a legal right in all patents. If Marconi does not give me a share of the proceeds from his French patents, I will appeal to Her Majesty, through Sir Wilfrid Laurier and His Excellency, the Governor-General of Canada, as a British subject, and ask for equal right in his patents for the British dominions. I will make the same representations to the President of the United States. My appeal to the latter will be based on the fact that my essay for the Hodgkin's prize of $10,000 was submitted by the Smithsonian Institute at Washington to the French scientists for examination in 1894, and it was from this essay Marconi first learned that the earth's electric energy collects in hills, mountains—in fact, all elevations on her surface. Marconi immediately began to erect towers, and, placing instruments upon their summits, they answered each other.

"But I am now even with him, for I have discovered that the telephone acts on the same wireless principle, and I will ask patents from Canada, Britain and even from France, and my telephone will thus supplant his telegraphy. Then, railway companies will take down their wires, for conversation can be conducted between stations, and even running trains; generals can talk with each other while the battle is raging by merely sticking their swords into the ground; ships will also speak with each other miles away, while we can converse, stretching our limbs upon the grassy lawn here, with the weary traveler trudging his icy way to the northern pole."

Prof. Wiggins further states that volcanoes, like Vesuvius and Ætna, owe their heat entirely to the electric energy that they collect from the adjacent seas, mountains and country. He predicts that before the close of the twentieth century, towers of great height will be built all over the continents and on the sea; and these, burning by the earth's electric energy, will give eternal light to the surface of our planet. With small towers with wire coils, the summits of the Rockies could now, at little expense, become a row of glowing torches from Cape Horn to the Arctic Circle.

Endurance Tests for Automobiles.

Arrangements for the endurance test to be given by the Automobile Club of America have been planned by the technical and contests committee. It was decided that the test would be of utility only, speed being relegated to the background. Awards will be made on the following grounds:

First—Vehicles making fewest stops en route.

Second—Vehicles carrying greatest weight in passengers in proportion to their own weight.

Third—Vehicles requiring least repairs (if any) and maintaining an average speed of from 12 to 15 miles an hour.

Stops will be made en route for sleep and meals, but no special fuel stations will be provided, competitors relying upon the towns en route for all supplies. An average of 100 miles or more a day is counted on.

The route will be through Tarrytown, Peekskill, Poughkeepsie, Albany, Utica, Syracuse and Rochester to Buffalo and return. Checkers and other officials will be stationed at villages en route at an average distance of about 25 miles. The competition will be open to all motor vehicles carrying two persons side by side on one seat, motor bicycles, motor tricycles and motor quadricycles being barred.

There will be two classes, one for manufacturers and the other for private owners. The entry fee for the former will probably be $100. A prize fund of $2,500 has been established, and awards may be made both in specie and plate, though this has not been definitely decided upon. The date, also, is yet open, though it is thought conditions will be more favorable in the early autumn than at any other time.

In addition to being an endurance test, the run is expected to be made a traveling exhibition, as was the case in England. Efforts will be made to secure a very large entry list, so that the local showings en route may be as effective as possible.

Street Railways in New York State.

The New York State Board of Railroad Commissioners has issued its annual report. The percentage of dividends to capital stock of street surface railroad companies for the year ending June 30, 1900, was 3.77; in 1899 it was 4.67. The number of passengers carried on all the street surface railroads of the State, including the few remaining horse railroads and the elevated roads in Brooklyn, was 1,801,974,097, an increase over 1899 of 122,684,693. The number carried in the boroughs of the Bronx and Manhattan, including transfers, was 567,144,099, an increase over 1899 of 57,829,283. The number carried in the Borough of Brooklyn, including transfers, and including those carried by the elevated railroads in Brooklyn, was 323,229,639, an increase over 1899 of 45,584,744.

The total number of passengers carried by the Manhattan Railway was 184,164,110, an increase of 9,839,535, as compared with 1899. The earnings and operating statistics of the Brooklyn elevated railroads are included in the report to this board made by the Brooklyn Heights Railroad Company.

Fifteen passengers were injured and four employees killed on the Manhattan Elevated Road, while 148 people were killed and 650 injured on the street surface roads.

The average number of persons employed on all of the street surface railroads of the State, including the elevated railroads in Brooklyn, was 28,075, and the aggregate amount of salaries and wages paid them was $16,968,907.05. The companies owned or operated 5,098 electric and cable box cars, 3,666 electric and cable open cars, 23 air motor box cars, 22 electric mail cars, 626 electric and cable freight, express and service cars. There were 2,437 other cars in operation.

Annual Meeting of Contractors.

The annual meeting of the United Electrical Contractors of the State of New York was held in Utica on Jan. 15, the session being held in Arcanum Temple. There were present representatives from all the members of the association, including delegations from New York, Albany, Rochester, Syracuse, Buffalo and Utica. The delegates passed on many matters of importance to the trade. The election of officers resulted as follows: President, Rudolph Schmidt, Rochester; vice-president, Mr. Davis, New York; treasurer, J. C. Stearns, Buffalo; secretary, W. H. Morton, Utica. Directors: Charles Eidlitz, New York; F. L. Frost, Albany; W. H. Morton, Utica; James Hilton, Syracuse; Mr. Olmstead, Rochester, and J. C. Stearns, Buffalo. In addition to the regular business with respect to the trade, E. A. Fitzgerald, inspector of the New York State Board of Underwriters, appeared before the association in regard to insurance inspection. Lunch was served the delegates and visitors in the rooms of the Arcanum Club. In the evening a banquet was served in Watson Hall in the Huron block. About 40 sat down and the occasion was one full of interest and good fellowship. There were several visitors representing different firms of electrical supply dealers.

Electrical Development in England.

According to the statistics of Mr. Emile Garcke, the capital involved in electrical undertakings in the United Kingdom has increased in one year from just under £106,000,000 to £123,636,602, exclusive of the Government telegraphs and telephones, the greatest increases having been in connection with supply, traction and manufacturing works. In five years the total capital has been doubled, while the money involved in electrical manufacturing concerns has increased from £6,500,000 to £21,708,180, and of this increase £5,000,000 is credited to 1900, chiefly light, power and trolleys. Five years ago, less than 14,000,000 sterling were thus involved; now the total is 55,000,000, and schemes projected will swell this total enormously in the next few years. Thus, in Parliament last year 98 provisional orders were granted for the construction of supply works, bringing the total orders still in force to 527; while many also of the 89 stations authorized in 1899 are not included in the capital sum named above. In operation, or under construction, there are 169 municipal and 108 company-owned stations, the sum involved in the former being £13,776,372, and in the latter £12,434,827. Under the former head there has been a very much greater advance than in the case of companies. Thus, five years ago, the capital of company supply stations was three times that of municipal loans; now the latter excels. In other words, the company capital has only doubled in five years, the municipal loans have increased sevenfold. In traction schemes there has been an increase in the five years from 6 to 28.89 millions sterling; but here private enterprise still holds the field, for of the total only £2,748,873 is held by 18 municipalities, while over £26,000,000 has been found by 75 companies. It would be easy to prove, also, that there has been great progress towards the reduction of costs of production. The average cost of generation has been decreased in five years from 2.45d. to 1.79d., with the corresponding reduction in other items, and the total cost is now 2.67d. against 4.07d. per Board of Trade unit. In five years the number of 8-cp lamps connected has increased from 2 to 7.66 millions, and the units sold in even greater proportion from 30,000,000 to over 125,000,000. The price obtained for current has, in the case of companies, decreased from 6.08d. to 5.26d., and in municipal undertakings 5.32d. to 4.06d. per unit. The percentage of profit on capital expenditure has not increased—being, for municipalities, 4.90, and for companies, 5.45 per cent.

Test of Gasoline Automobiles.

The officials of the Electric Vehicle Company at Hartford, Conn., completed a severe test of the gasoline automobiles on Saturday night, Jan. 19. It was under the direction of H. Percy Maxim, chief engineer of the company. Ten trips to Springfield and back were made without stopping the engines once. There was about 3 in. of snow on the ground, and the temperature varied from 12 degs. above to 2 degs. below zero. The start was made at 6.30 o'clock in the morning, and the finish was at 11 o'clock at night. The fastest time was made by Mr. Maxim on his second trip, when he covered the distance from the company's place to the South End Bridge, in Springfield, in 1 hour and 10 minutes, a distance of 21.37 miles. The average for the entire run, counting the slow rate made by the vehicle when the men were forced to walk by reason of the cold, during the time the tank was being filled, and all other causes taken into consideration, was 13.1 miles per hour. The last three trips, a total of 162 miles, were made at the rate of 20.1 miles an hour. The only serious accident was the cutting of a tire by the sharp ice, and this tire had to be replaced on the vehicle reaching this city. The engine did not stop running while the tire was being replaced.

Missouri River Telephone Association.

The Missouri River Telephone Association was organized at St. Joseph, Jan. 10. About 20 exchanges and toll lines in Northwest Missouri, Southern Iowa and Eastern Kansas are members. The officers are H. E. Ralston, Maryville, Mo., president; G. A. Haynie, Savannah, Mo., vice-president; L. N. Fry, Granite City, Mo., secretary and treasurer. These, with F. S. Travis, of Tarkio, and J. T. Norman, of Stanbarry, constitute the Executive Committee. The object of the association is to establish uniform rules governing exchanges and for mutual protection. The members of the Executive Committee were elected delegates to the Interstate Telephone Association, which met in Kansas City, Jan. 15.

CURRENT NEWS AND NOTES.

EXPOSITION HONORS.—The list of decorations bestowed on Americans by the French Government, in connection with the Paris Exposition, has just been published. J. P. Morgan and F. J. V. Skiff are made officers of the Legion of Honor. Among the chevaliers of the Legion are F. E. Drake, C. A. Moore, C. A. Griscom, C. A. Coolidge, Carl Hering, F. C. Pratt, E. W. Rice, Jr., Ambrose Swasey and George Westinghouse.

COMPOSITION FOR CLEANING METALS.—A patent granted Jan. 15 to J. L. Bach, gives the following formula for a metal-cleaning composition: Pure water, 1 gallon; potassium carbonate, 1 ounce; potassium cyanide, ½ ounce; sodium carbonate, ½ ounce; chloride of sodium, 1-10 ounce. The solution is used at the boiling point, and a strong electric current employed. A formation of gas takes place, which immediately separates all grease or other impurities from the object exposed and renders it chemically clean.

APPARATUS FOR MELTING IRIDIUM.—A patent issued Jan. 8 to G. Armeny and W. C. Marion describes an apparatus for melting iridium in small quantities with or without a small percentage of another metal for attachment to the nibs of gold pens. A carbon plate is provided with a plurality of depressions for receiving iridium in small quantities, and forms one electrode of an electric circuit. The second electrode is a carbon rod secured to a handle, and is placed successively over the iridium in the depressions.

HIGH-TENSION CUT-OUT.—A cut-out for high-potential circuits is the subject of a patent granted Jan. 15 to W. L. R. Emmet. A chamber is formed between two insulating and fireproof bodies, in which a fusible cut-out is inserted, the fuse being held under tension. On one side of the chamber is a contracted opening to the atmosphere, through which the gases formed on rupture of the circuit pass and act expulsively to extinguish the arc. To protect the walls of the chamber it is lined with a removable capsule of paper saturated with a hydro-carbon or other gas-producing material.

PURE HELIUM.—Prof. Dewar, in a lecture last week before the Royal Institution on the advance in the knowledge of gases during the nineteenth century, expressed disappointment that the experiments in the institution's laboratory had failed to produce pure helium. He said he longed to find a rich man generous enough to supply funds for the experiments necessary for the discovery of pure helium, but he was aghast at the possible expenditure. Its discovery would enable the realization of Lord Kelvin's idea that a temperature within 5 degs. of absolute zero can be reached. Prof. Dewar added that he did not know why the reaching of absolute zero should be regarded as hypothetical.

NEW YORK ELECTRICAL SOCIETY.—The 211th meeting of the society, through the courtesy of the New York Gas & Electric Light, Heat & Power Company, will be held at the Edison station, corner of Elm and Duane Streets, on Wednesday, Jan. 30, at 8 p. m. Dr. Louis Bell will deliver a lecture on "Electric Illumination at the Beginning of the Twentieth Century." Unusual preparations have been made for this lecture. Ladies will be welcome, and a collation will be provided with the aid of the company's electric kitchen. It will be remembered that this lecture was postponed on account of Dr. Bell's attack of grip, a circumstance which has happily been availed of, however, to make the proposed experimental demonstrations more complete and interesting.

MOTOR CONTROL.—Two patents were granted to M. Waddell on Jan. 15, on motor control by means of a secondary motor in series, which sets up a counter e. m. f. The application for one patent was filed March 23, 1887, and for the second or method patent, Jan. 13, 1897. Both patents are assigned to the General Electric Company. The method has for its object to dispense with the usual motor-starting resistances, for which is substituted a second motor of smaller size, which having a comparatively inappreciable load to carry will at once attain its full speed and full potential. The speed of the small motor is then diminished by mechanical means or otherwise, thereby lowering its counter e. m. f. and permitting a current to flow through the large motor, the latter beginning to operate when this current reaches a certain point. The speed of the small motor being still further decreased, the potential of the large one will increase until, when the small motor is stopped, the large one is running on full potential, at which time the small motor may be cut out of circuit.

"BUSY."—In speaking to a *Mail and Express* reporter, Mr. Herbert Laws Webb, of the New York Telephone Company, gives some interesting data as to the daily work in this city. The line of the load curve described by Mr. Webb rose to two peaks, one showing the business at 10 o'clock, the other about 1 o'clock in the afternoon. Between these is a considerable depression on both sides, steep and low declines. During the day in all the 13 central stations there are 400,000 cells, of which about 325,000 make connections. Fully 90 per cent of all the calls are made between the hours of 9 a. m. and 5 p. m. Only 10 per cent are made between the hours of 5 in the afternoon and 9 in the morning. This, said Mr. Webb, is one of the difficulties of the telephone business. There are two or three rush hours, when the business done is tremendous in comparison. But a force must be employed and a plant used to meet the greatest demands, while at other hours a far smaller force and a much smaller equipment would do. At the Cortlandt central station, the largest in the city, there are 75,000 calls daily, but less than 1,500 of these come between 6 in the evening and 8 in the morning. All the other stations maintain nearly the same proportion.

NEW ELECTROLYTIC PROCESSES.—Among the patents of Jan. 15 are two on new electrolytic processes, the subjects being the electrolytic production of nickel and allied metals, and the electrolyzation of soluable salts. The latter—granted to A. J. O. Chalandre and L. J. B. Colas, of Paris, France—applies to salts, the electrolyzation of which causes detrimental secondary reactions in the electrolyte. The process consists in combining outside the apparatus part of the gases from the anode and cathode compartments to form an acid, then introducing this acid in the anode compartment, where it annuls detrimental secondary reactions. The specifications describe the application of the process to the electrolyzation of sodium chloride to procure sodium hydro-oxide on the one hand, and pure chlorine on the other, in the proportions they are combined in salt. The other patent was granted to Moritz Kugel, of Berlin, Germany, and relates to the production of electrolytic nickel and allied metals in layers of desired thickness in such manner that the product is equal to rolled nickel as regards its mechanical properties. The process consists in keeping the electrolyte at a temperature over 30 degs. C., maintaining the electrolyte acid by the addition of a strong mineral acid not changeable by the current, and adding a highly-concentrated solution of a light metal salt, also not changeable by the current. Nickel sulphate and magnesium sulphate are named as the two constituents of the electrolyte.

ELECTRIC WELDING.—Three patents were issued Jan. 15 on electric welding apparatus, two being granted to Elihu Thomson and the third to A. F. Rietzel. Both of the former relate to means for operating electric welding apparatus from a direct-current supply by the use of the Wehnelt interrupter. In one case the transformer has a straight magnetic core, around which is a primary coil in close inductive relation to the welding secondary, to which clamps for holding the work are attached. In the primary is an interrupter of the Wehnelt type. The second patent describes a transformer with a closed magnetic circuit, which contains a third or auxiliary coil termed a "depolarizing coil." The object of the third coil is to maintain a continuous magnetic polarization of one sign or direction. A closed iron core tends to maintain its magnetism even if the magnetizing current is broken or cut off. The polarizing coil is wound in opposition to the primary, having in its circuit a Wehnelt interrupter, which latter produces a rapidly interrupted direct current of a power sufficient to overcome the effects of the depolarizing coil and reverse the magnetism of the transformer. The Rietzel patent relates to details of electric welding apparatus, which fit it more particularly for use in electric welding of tubes, cylinders and other forms of work which are made from sheet metal pressed or formed into their respective shapes, and welded along the seams. The apparatus is so constructed that the work to be welded is practicably out of the field or magnetic circuit of the conductors, this not being true of similar apparatus heretofore constructed. The welding current passes from one terminal of the secondary to a disk or roller bearing on the welding edge of the tube, thence across the seam and through the adjacent welding edge of the tube into the other secondary terminal.

THE NEW YORK ZOOLOGICAL SOCIETY, in reporting a very successful year, states that it is building a motor road in Bronx Park and that the society will operate on it automobiles of its own for the convenience of the public.

WIRELESS TELEGRAPHY IN THE FRENCH NAVY.—A dispatch from Toulon states that the recent experiments with wireless telegraphy in connection with the French fleet have been so satisfactory that it has been decided to provide the Mediterranean squadron with wireless apparatus, which will be subjected to decisive tests. The recent experiments showed that dispatches can be exchanged reliably at distances of from 18 to 20 miles by the new system.

LONDON UNDERGROUND.—A cable dispatch from London, of Jan. 16, says: "It is understood here that Tom L. Johnson, the American street railroad capitalist, has bought the Baker Street & Waterloo Underground Railroad from the London & Globe Finance Corporation, Limited. The officials of the company, however, decline to give the name of the purchaser. It is understood that the price, £500,000, carries a concession to extend the surface lines to Brighton, which Mr. Johnson tried to secure a year ago." This purchase is denied by the Johnsons.

THE NERNST LAMP.—At a recent meeting of the Frankfort-on-the-Main Association of Electrical Engineers, Herr Wolff, manager of the local branch of the Allgemeine Elektricitäts-Gesellschaft, showed a new form of Nernst lamp. The necessary initial heating of this lamp is effected by a spiral of platinum embedded in fireproof composition. By means of a switch neatly concealed within the base of the lamp, this spiral is automatically cut out of circuit after the lamp has been rendered sufficiently conductive by the imparted heat. The lamp exhibited was of 25 cp.

VISITING ENGINEERS.—The American Society of Civil Engineers held its annual meeting in this city last week. On Thursday, by invitation of Thomas E. Murray, general manager of the New York Gas & Electric Light, Heat & Power Company, J. W. Leib, Jr., general manager of the Edison Electric Illuminating Company, and John Van Vleck, constructing engineer of both companies, the party inspected the new waterside power station, in course of construction, at Thirty-eighth Street, East River. A stop was also made at the new power station of the Manhattan Railway Company at Seventy-fourth Street, East River, recently illustrated and described in these pages.

LONG ISLAND AUTOMOBILISTS.—Theodore Roosevelt, Vice-President-elect of the United States; Lieut.-Gov. Timothy L. Woodruff and Richard Dudgeon, of Locust Valley, have been elected as the first honorary members of the Automobile Club of Long Island. The honor was conferred upon Mr. Dudgeon in view of the fact that he is acknowledged to be the first automobilist on Long Island, some fifty years ago. The club took up the subject of placing sign posts on highways, and will at once begin the erection of forty iron sign posts at prominent points on Long Island roads. This is one of the steps toward carrying out a general placing of such road marks throughout the country, as determined upon by the Automobile Club of America.

A JERSEY MUNICIPAL GAS PLANT.—The new Hudson County Board of Freeholders has made a contract with the Hudson County Gas Company to supply gas to the county institutions for less than half of what it has cost the county for many years to run its own gas plant for this purpose. In seeking for plans to enforce economies, in accordance with the mandate of over-burdened taxpayers, the new Freeholders saw in the gas extravagance a shining mark. The county has had to pay about $2.50 per 1000 ft. for gas to suppy the county institutions, and at the same time the local gas company offered a better gas at less than half the rate, the contract agreement being at slightly lower figures than the $1.10 rate now charged to private consumers. "That will be about the last of the municipal gas-piant idea in Hudson County," said a taxpayer there. "Those fellows pretended to run it in the interest of taxpayers, but I guess about all they did was to make a political machine out of it and gather in money."

MORE SUBMARINE CABLES.—A cable dispatch from Berlin of Jan. 19 says that the project of a net of cables to cover the world is being diligently pursued by Germany, and is most actively furthered by the Emperor, who made some significant utterances on the subject to Privy Postal Councillor Strecker recently. The latest shape of the project, so far as the Far East is concerned, is as follows: Germany and the Netherlands to jointly lay a cable, which will go through the Dutch Indies, touching at the Natuna Islands, Billiton, Palembang, Batavia, Macassar, Amboina, German New Guinea and the Carolines, with a central point at Shanghai, thence branching from Kiao-Chou easterly to Japan and America. The Dutch Government will lay the cable through its own colonies, and Germany will do the rest. The financing of this project is about concluded in principle. The plan of General von Podbielski, the Imperial Postmaster-General, for gradually raising the annual appropriations to a maximum of 6,000,000 marks in 1920 has been approved by Emperor William. But if private companies, with a State subvention, will undertake the work, General von Podbielski will not object.

CATHEDRAL CHIME RINGING.—The bells and chimes of St. Patrick's Cathedral, New York City, are now rung by compressed air and electricity. The big bell weighs 6000 lbs. The 19 chime bells weigh from 270 lbs. upward. The installation was made by H. C. Champ, of Brooklyn. William F. Wynn, consulting engineer to the trustees, in describing the plant, says: "It is an adaptation of the compressed air cylinder adopted by the Union Switch & Signal Company. Mr. Champ, in following their idea, constructed 19 bell engines, corresponding to the number of bells. These bell engines are bolted to wooden seats, which in turn are bolted on a system of steel beams inserted in the walls of the north tower. These engines consist in their working parts of a fine grade of bronze composition metal, so as not to rust or corrode. The engines practically consist of three main parts, two cylinders and a piston, which is fitted to a clip hung on the clapper of the bell above it. On the engine there is an adjustable clevis, so that the stroke can be arranged to a nicety, and, once so adjusted, it cannot change its position. The engines are operated from the sacristy by means of a keyboard. A key being depressed, a current of electricity is sent along its wire to the belfry, where, by means of an air valve operated through an electromagnet, the compressed air is admitted to the bell engine, and the air pressure delivers the blow, which acts upon the clapper, and rings the bell."

LETTER TO THE EDITORS.

Wireless Telegraphy Over Frozen Ground.

To the Editors of Electrical World and Engineer:

Sirs:—I should like to make a correction in your columns of a statement made by me in the discussion on Wireless Telegraphy at the Am. I. E. E. meeting of last year. I there stated that according to my experiments frozen ground made little difference in the transmission of signals, the waves apparently going down to the moisture under the frozen surface.

Whilst this statement was correct for the case tested, it does not hold always. The experiments on which I based this conclusion were made on a gravelly soil, with cinders overlying a clay bottom. Consequently, the frozen moisture was probably highly charged with salts, and was a fair conductor.

I have, within the past few months, had an opportunity of testing the effect over a stretch of land of a different nature. Two stations between which I have been working—one at Cob Point, Md., the other at Arlington, Va.—are 47 miles apart, the line between them passing entirely over open land, with the exception of half a mile of water, and through the City of Alexandria, a few miles from Arlington. The land is practically all well wooded, and the trees of considerable height.

Several sets of measurements were made in fine weather, and fairly accurate results obtained. A severe frost then set in, and the ground was frozen to a depth of several inches. It was found that under these conditions the signals received had only one-seventh the power of those received in warm weather; that is, for equally good transmission, we had to use seven times the power that we used in warm weather. It is evident therefore that in some places, possibly in most places, frost will form a very serious obstacle. I may say that the ratio will not always be one-seventh, but will be still larger for longer distances.

In this connection I would point out that the usual formulæ for

the capacity of a vertical wire or cylinder are not correct, being from 500 to 1000 per cent out. After considerable labor, I have succeeded in getting approximately correct formulæ, which I will give later. The usually given formula for the self-inductance is also incorrect, but the correction has been given by Heaviside. As an example of the approximate accuracy of the new formulæ, the calculated wave length was 254 ft. and the actual length as measured was 250 ft.

The design of stations for wireless telegraphy is now on exactly the same footing as the design of telegraph lines, and the laws are now fully understood. It is perhaps unnecessary to add that the various wild hypotheses of equipotential surfaces in the air or in the ground, of "wobbling" earth charges, etc., have been definitely disproven, the matter being a plain, simple case of ordinary electrodynamics.

With regard to the so-called Martian signals, these external disturbances have long been known, and only the crassest ignorance could attribute any such origin. They formed at one time a serious obstacle to multiplex systems, but are now eliminated. The different kinds are easily distinguishable, i. e., those due to lightning flashes anywhere within 100 miles or more, those due to street cars, etc., and those due to the gradual electrification of the vertical conductor by the air currents. This last gives, unless eliminated, signals at regular intervals, and by those ignorant of the subject, might be mistaken for intelligent signals.

Some work was done with the coherer, for the purpose of making comparative tests. Lodge's theory was confirmed. After long use the particles are found strung together in groups by thin ligaments of metal. Decohering can be obtained with all metals yet tried. The action observed is as follows: With small discharges the microscopic points of contact are fused off and the circuit opened. This gives decoherence. With greater discharges, the points are fused, but the fusion extends over a greater extent, and the electrostatic attraction draws out a thin tongue of melted metal till the gap is bridged. This gives coherence. Arsenic and other metals which do not fuse (except under great pressure) do not cohere, except when oxidized slightly on the surface. Then a discharge sufficient to reduce the oxide causes coherence, but a larger current burns away the contact points and causes decoherence; and as the metal does not fuse, larger currents do not cause coherence. The action of such materials as silver bromide is due to the fact that, after reduction and coherence, the now active bromide combines again with the silver. I gave a description of a coherer worked on this principle about a year and a half ago, in a review I wrote on Lodge's book, for this journal. All of Bose's experiments are therefore quite in accordance with Lodge's theory.

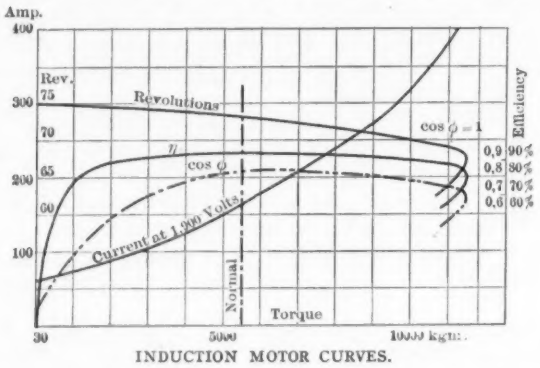
The amount of senseless and sensational stuff which has been written about wireless telegraphy suggests that the little knowledge, which the poet assures us is a dangerous thing, may have a certain function. That is, a very small amount of knowledge gone bad, of no particular use even to the owner, may yet, when spread in a thin film over the columns of the newspaper, give rise, by its very superficialty and tenuity, to a pleasing and striking iridescence. But, after all, it is only scum, and an evidence of the drink underneath. The fount of truth has another appearance.

Washington, D. C. R. A. Fessenden.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE.

Dynamos, Motors and Transformers.

Induction Motor.—An illustrated description of a 600-hp three-phase induction motor, running at 75 r. p. m., made by the Oerlikon Company for pumping water in a mine in Germany. A special condition was that the motor had to be transported through a shaft of 2 x 2 meter cross-section, and that the maximum weight that could be hauled was 1000 kg. The main difficulty for the designer was to prevent excessive magnetic leakage. A three-phase generator of 840 hp was also to be furnished, direct connected to a steam engine running at 90 r. p. m. A frequency of 22.5 was chosen; the generator has 30 poles, the motor 36 poles; the voltage at the terminals is 1900. The diameter of the rotor is slightly less than 3 meters; the air gap between rotor and stator is 2 mm. The three ends of the windings of the rotor are connected with three short-circuit contacts and also with three slip rings, upon which three brushes are sliding, which make connection with a large starting rheostat. The external diameter of the case is 4 meters, the breadth 0.9 meter, the



INDUCTION MOTOR CURVES.

total weight 28,000 kg., the weight of the rotor 11,000 kg. The results of tests are as follows: Resistance of the winding of a phase of the stator, 0.4 ohm, the stator being delta or ring connected; resistance of a phase of the rotor, 0.016 ohm; for the motor running with no load at 75 revolutions, 1900 volts, 62 amperes, 22.5 periods, 16 kw; for the motor at rest, with short circuited rotor circuits, 390 volts, 110 amperes, 22.5 periods, or 600 volts, 200 amperes, 22.5 periods. The leakage co-efficient for a load of 190 amperes is 0.1. The losses for friction and ventilation are 3.5 kw. The heating of the iron, when the motor runs with no load, is 18 deg. above the surrounding temperature. In the adjoining diagram the current, the number of revolutions, the power factor, and the efficiency, are given for varying torque under the assumption of a decreasing leakage co-efficient. The maximum torque is 11,500 kg. m., equal to double the normal.—*Elek. Zeit.*, Dec. 27.

Lights and Lighting.

Train Lighting.—An article on the Vicarino system of train lighting. He "uses an axle-driven dynamo fitted with in ingenious arrangement of brush holder, whereby the direction of motion of the carriage is rendered immaterial. This dynamo supplies light to the carriage lamps in connection with a small battery of accumulators. An auxiliary apparatus cuts the accumulator in and out at the proper moment, and is also arranged to equalize the voltage, so that the pressure at the lamps does not vary very much. The dynamo is compound wound, the series winding being arranged to oppose the effect produced by the shunt winding. The general principle upon which the whole arrangement is based, is that at the normal speed of the train the dynamo is driving the lamps direct; at lower speeds the accumulators supply the lamps, and at higher speeds the surplus current generted by the dynamo over and above that necessary for the lamps, goes to charge the battery. The system is in use in Nancy. The first cost of installation per car for different systems is given as follows: Oil $40, gas $160, a storage battery of 120 ampere hours for eight 10-cp lamps $190, the Vicarino system for eight 10-cp lamps with a battery of 40 ampere-hours' capacity $250. The cost per year, assuming the car to be lighted on the average 4 hours per day, is given as follows: Oil, four 5-cp lamps, $53; gas, four 10-cp lamps, $41; accumulators, eight 10-cp lamps, $58; Vicarino system, eight 10-cp lamps, $14.—Lond. *Elec. Rev.*, Jan. 4.

The Trouble with High-Voltage Arc Lamps.—Griffin.—An illustrated article on the troubles experienced in Burnley and other British towns with the new high-voltage arc lamps, after the supply voltage at the consumers' terminals had been raised from 105 to 220. "The principal faults of the 220-volt arcs, in comparison with the low-voltage lamps were as follows: The carbons lasted less than half the time, far more heat was given off, the light was not nearly as steady, and lastly, but chiefly, the arc gave scarcely one-

fifth of the light, and that fifth of such a quality that it was utterly impossible for any shopkeeper to distinguish the different shades of his colored materials. Various other makes of lamps were tried without success, and it was finally decided to return to the old 105-volt lamps and to supply them from a 5-wire system, as follows: The main generator gives 440 volts, this voltage is divided into 2 x 220 volts for the 3-wire system by means of a balancer, consisting of two machines. Two small balancers have now been connected across both sides of the 3-wire system, and from the middle wires of these small balancers cables are run through the afflicted arc lamp district. He says that the customers are now again satisfied, and recommends this system wherever the arcs are not distributed over a wide area.—Lond. *Elec. Rev.*, Jan. 4.

POWER.

Electric Distribution of Power in Workshops.—An interesting discussion at the Franklin Institute, which was opened by Crocker, who discussed the subject under the following headings: Saving in Power; Cost of Buildings; Cost of Equipment; Arrangement of Machinery; Clear Head-Room; Cleanliness; Health of Employees; Convenience for Detached Buildings; Freedom for Growth; Shut-Downs Less Frequent and Less Serious; Speed Control; Increase of Output. Vauclain made some very interesting remarks on the highly successful adaptation of independent electric motors to machine tools in the Baldwin Locomotive Works: "If we should abandon electric driving our manufactured product would now cost us from 20 to 25 per cent more for labor"; "were it not for electric driving, the Baldwin Locomotive Works would have to cover 40 per cent more floor space than they now do, to maintain their present output." Dunn discussed the methods of obtaining adjustability and controllability of speeds, which he considered to be one of the greatest advantages accompanying electric power, either control by armature resistance, or by field resistance, or by variation of voltage of the circuit. Tapley gave an account of the results obtained in the Government Printing Office. The cost of the whole electric plant was $150,000. The benefits derived during the five years they have used electric power, have equaled the cost of and maintained the entire electric equipment, and the saving in coal and gas has been paying 10 per cent on the investment after making an allowance of 6.6 per cent for insurance, taxes and interest. Elgin spoke about the installation of motors, and expressed the wish that all the auxiliaries necessary for the operation of the motor should be arranged in a compact form and enclosed firmly in an iron box, the operations of starting and stopping being controlled by a single lever which should be provided with stops, so that the motor could not be accidentally started or stopped. Dougherty spoke in favor of a certain flexible conduit for portable connections, and wished that the tool maker and the motor maker should consult each other in regard to just what they want. Kennelly said that in order to develop the best capabilities of modern machinery, makers of machinery are gradually leaning to the constructions which involve individual direct connection with electric motors. Hering said that the induction motor appears to be an important step toward the ideal motor for use in workshops, as it has no commutator, is extremely simple in construction, and requires no attention, except oiling. It runs at nearly constant speed. He referred to the great progress that has been made in Germany and Switzerland in the introduction of induction motors. Dunn criticized the induction motor unfavorably, and said that for factory distribution the direct-current motor possesses many advantages over the alternating, especially on account of the adjustability of speed and because the starting torques of induction motors are much less than those of direct-current machines. He acknowledged that in Europe induction motors are more widely used, because the direct-current motor was not so well developed there as in this country. Here commutators are made now that run with but 1-64 of an inch wear per year, served by carbon brushes that operate with a wear of from 1-32 to 3/8 of an inch per year. Hering replied to the adverse criticisms of Dunn, and defended the induction motor. He admitted that their constancy of speed is sometimes a drawback, but that such cases are the exception. It is one of the reasons why it is not so well suited for traction in cities.—*Jour. Frank. Inst.*, Jan.

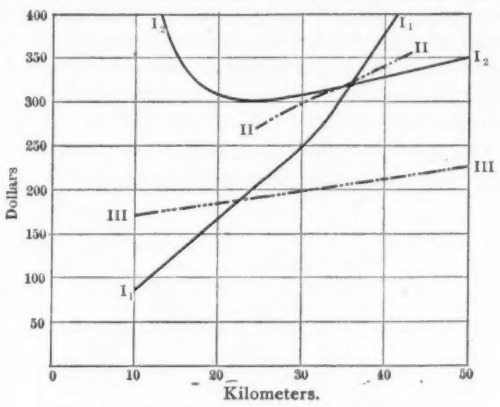
Electricity in Coal Mining.—JACKSON.—A Franklin Institute paper on electric apparatus in coal mining. He starts with general remarks about mines, the effect of number of openings and rapidity of working upon the efficiency, the location of the station and character of power, and the systems for the application of power. The most suitable insulation of wires is a triple braiding of cotton or linen thoroughly impregnated with an insulating waterproof pitchy compound. After the wires are put up, it is also desirable to paint them with two or three coats of this compound. Voltage of not over 250 should be used wherever the mines are not of so great extent as to make the cost of copper excessive, and that where the extent of mines requires 500 volts, special precaution should be taken to protect the workmen. Wiring should be done very carefully. The return circuit should be made just as substantially, by means of a proper bonding of the track, as would be done in a well-equipped passenger railway system. Where pipes run near the tracks they should be carefully connected at short intervals to this return circuit by means of substantial copper wire taps; failure to do this has caused the destruction of much piping, due to electrolytic action. He then describes forms of electric locomotives, cutters, longwall machines, shearing machine, electric drills, pumps, hoisters and fans.—*Jour. Frank Inst.*, Jan.

REFERENCE.

Handling Coal in Power Stations.—The first of a series of illustrated articles on "Coal and ash handling, and storage plants for electric light and power stations." In this installment a plant is described which is working at the electric tramway power station in Leeds, for unloading barges, each containing about 80 tons of small boiler coal.—Lond. *Elec. Rev.*, Jan. 4.

TRACTION.

Current Supply to Long Railway Lines.—RASCH.—A long paper, illustrated by diagrams and giving a comparison of the following three systems, which may be used when, on account of the extension of the road, the amount of copper would be too great with a direct-current supply at about 600 volts from a single station. First, direct-current supply from several independent stations. Second, direct-current supply from one generating station and one or more sub-stations, the transmission to the sub-stations being by high-tension alternating currents. Third, three-phase traction, with one generating station and step-down transformers along the road. In the comparison of these systems the following suppositions are made: A straight road is assumed, the transmission line following along the road. A uniform load is assumed, i. e., a kw are consumed per kilometer, where a is a constant along the road; in practice a is between 5 and 15, in the diagram below it is assumed as 10. It is also assumed that for the choice of the site of the station, only the most favorable distribution of current is to be considered. For the comparison of the three systems he calculates the cost per kilometer and year for transmission and distribution of current, and also for the generation, so far as this cost is greater in one system than in the others. The result is given in the adjoining diagram in which the abscissas represent the length of the road and the ordinates the comparative cost of each system. From the diagram it can therefore be seen which system is the cheapest for a given length



CURRENTS FOR LONG RAILWAYS.

of road. The curve I_1 is for the direct-current supply system from one station, the curve I_2 for the direct-current supply system from two stations, the voltage being 600 in both cases. It will be seen that one station is cheapest as long as the length of the road is below 36 kilometers, this one station being in the center of the road. When the length of the road is greater, two stations are cheaper. The curve II is for the system in which three-phase current is generated in a station at 5000 volts and transmitted to a sub-station, where it is changed by transformers and synchronous converters into direct current at 600 volts. In the generating station direct current is also

generated for the supply of the parts of the road in the neighborhood of this station. It is somewhat surprising to see that this system is always more expensive than the other; it should therefore be used only in exceptional cases. The author thinks that it can be used to advantage near where the lines for a direct-current supply from one and from two stations intersect, that is, where they are about equal. The conditions under which it is advantageous to this system, are a small total load and relatively great length. A system with more then one sub-station is still less advantageous. The curve *III* is for three-phase traction, with one station and step-down transformers along the line. It will be seen that this system is superior to all other systems, whenever the length of the road is above 22 kilometers. Below this limit direct-current supply from one station is cheaper. As mentioned above, this limit is calculated for $a = 10$, and in practice a may be between 5 and 15. For higher loads than 10 kw per kilometer this limit decreases to 20 kilometers, for smaller loads it increases to 30 kilometers. It will be seen that for greater lengths, three-phase traction is decidedly the cheapest.—*Elek. Zeit.*, Dec, 20, 27.

Electric Automobiles.—JOEL.—A long article in which he first briefly criticizes the earlier attempts to produce electric carriages, in which the weight of the carriage was out of all proportion to the weight of the battery carried on it. He then discusses the improvements made in recent years, especially in the motors, controllers and batteries. Among other things he points out that the use of zinc with peroxide of lead gives a higher e. m. f., given as 2.45 volts by Wheatstone, than lead and peroxide of lead, but necessitates the use of porous pots. This battery has the advantage in common with other types of porous cell storage batteries that it can be quickly charged; a battery of 120 cells is charged in two hours with 90 amperes, and can be discharged at 20 to 60 amperes, whereas the best form of pasted type must be charged at 20 to 40 amperes, but is more efficient, gives a greater output for the same weight, and is more durable. The following system of control is recommended: Starting on the basis that the greatest power is required for hill climbing, the motors are then in parallel, and are working at their normal speed and highest possible efficiency; the limit battery discharge is not exceeded while the carriage is geared to ascend the hills at half speed. For running on level roads at higher speed the motors are overrun, and for slow speed the motors are coupled in series.—Lond. *Elec. Rev.*, Jan. 4.

REFERENCE.

Electric Traction.—DAWSON.—An article on the development of electric traction. Statistical data are given especially on the development in England and Germany.—Lond. *Elec. Rev.*, Jan. 4.

INSTALLATIONS, SYSTEMS AND APPLIANCES.

Central Station Costs in Great Britain.—A long and very full, statistical article on the costs of British central stations in 1898 and 1899. Several large tables and quite a number of diagrams are given. The adjoining two diagrams are reproduced as samples, both give the average costs for the four years 1896 to 1899, one for 52 municipal plants, the other for 33 plants owned by private companies. Municipal plants are discussed first. In the matter of total costs, Bradford heads the list as the best, with 2.36 cents total cost per unit sold. In

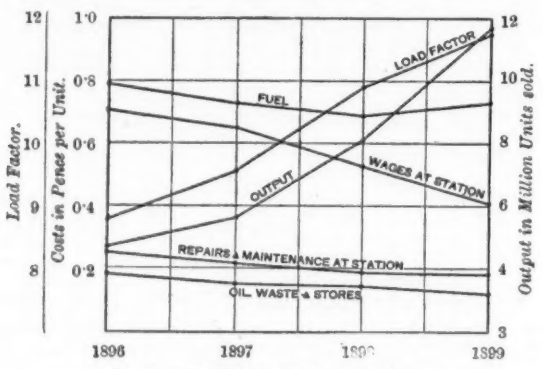


FIG. I.—CENTRAL STATION COSTS.

works cost Leeds is the best, with 1.48 cents per unit. All the items of cost per unit sold have fallen except that of fuel, which has increased by 6.42 per cent, in spite of the fact that the 1899 average is in conjunction with a mean output 44.2 per cent, and with a load factor 5.5 per cent above those respectively of 1898. Another interesting point is the gradual approach of the average total costs, plus 6 per cent on the mean capital, to the total revenue; in 1899 the average total revenue was 8.12 cents per unit, while the value of the total costs plus capital charges is 8.16 cents per unit. The lowest value of the latter quantity is 5.18 cents for 1898 for Edinburgh and 4.56 cents for 1899 for Halifax. It is of significance that the two stations which are best in this respect have a traction load. From other diagrams it appears that high-load factors are generally associated with high outputs; furthermore, the greater the output, the smaller the wages at the station, the generating costs, etc.; the output does not rise continuously with the load factor. Among the

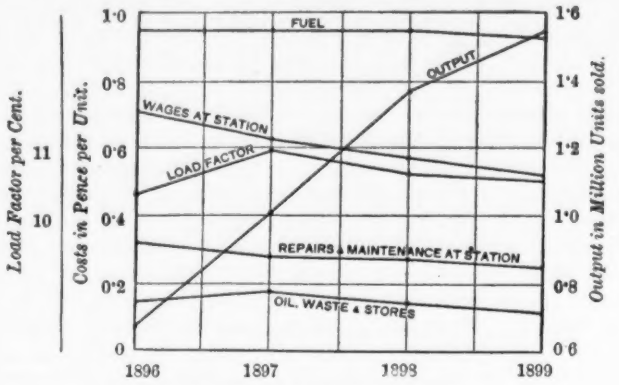


FIG. 2.—CENTRAL STATION COSTS.

plants owned by private companies the Charing Cross station has the lowest total costs, namely, 2.36 cents per unit. The lowest works cost are at Preston, namely, 2.04 cents per unit. The averages indicate increased economy in all the items of cost, and, rather surprisingly, a diminution of the load factor and the ratio of the output to the plant capacity. The lowest value of total costs plus 7 per cent of mean capital expended per unit, is 6.28 cents for the St. James station in London.—Lond. *Elec.*, Jan. 4.

ELECTRO-PHYSICS AND MAGNETISM.

Point Discharge from a Tesla Pole.—KNOBLAUCH.—An investigation of the following phenomenon: The discharge from a Tesla pole charges an insulated metallic plate positively at a certain distance and negatively at a greater distance. This is due to the greater speed and penetrative power of the negative ions. He has studied the distribution of the ions by means of perforated plates, and found that the positive charges are due to visible brush-discharges. When these brush discharges are prevented from impinging upon the plate by cutting out a central portion, no positive charge is obtained. The positive ions are strongest in the axial portion of the discharge.—*Phys. Zeit.*, Dec. 15; abstracted in Lond. *Elec.*, Jan. 4.

Spectra of Radium and Polonium.—BERNDT.—By means of Runge's method of fusing the salt into a platinum coil and then using it as an anode for a spark-gap, he has discovered no less than 15 lines of the polonium spectrum. He has also studied the radium spectrum. The spark was in all cases furnished by two Leyden jars charged by a large induction coil, and the platinum coil was kept in a state of incandescence. Under these circumstances the space between the electrodes was filled with the vapor of the salt, and the platinum and air lines were quite faint.—*Phys. Zeit.*, Dec. 23; abstracted in Lond. *Elec.*, Jan. 4.

REFERENCES.

Crookes Tubes.—WESTBURY.—An article on the use of the Crookes tube for the production of Röntgen rays, and on the best form of the tube.—*West. Elec.*, Jan. 5.

Thermo-Magnetic Phenomena.—MOREAU.—A theoretical paper in which he shows that the thermomagnetic effect, discovered by Nernst and Ettinghausen, is a Hall effect of special kind.—*L'Eclairage Elec.*, Dec. 22.

ELECTRO-CHEMISTRY AND BATTERIES.

Electro-Chemistry and Electro-Metallurgy in 1900.—J. B. C. KERSHAW.—The first part of his annual review. The last year has not been marked by any striking discoveries or developments in the electro-chemical and electro-metallurgical industries. The process for the manufacture of alkalies and bleach, of chlorates, and of hypochlorites, and for the refining of copper and bullion, all show progress during 1900. The development of the ozone and the aluminum industries is retarded by the limited field of application for these products. The process for the extraction of zinc and copper directly from their ores are still in the experimental stage of

their development. The number of factories engaged in the elctrolytic production of alkalies and bleach has increased to 27, with a capacity of 52,370 hp, three more factories being in course of erection; some of the processes used are briefly described. The Pittsburg Reduction Company is still the largest porducer of aluminum, the 1899 output being 2990 tons, while the 1900 output is expected to exceed this total by some hundreds of tons. The fall in the price of calcium carbide which has occurred during 1900 will not be without its effects upon the aluminum industry, for all the European aluminium works have taken up carbide manufacture, and now that this has ceased to yield any profit, a larger proportion of their power will be devoted to the production of aluminum. The total power now available for alumium production is 56,000 hp, but not more than one-half of this is at present utilized in the manufacture of the metal. All the factories use either the Herault or the Hall process. While many solders have been invented, none, with the exception of that of Richards, have given strong and durable joints; Heraeus has succeeded in joining the metal by a new method of autogenous soldering. He makes use of the fact that at a certain temperature, far below its melting point, aluminum becomes plastic and can be kneaded. The edges of the plate or ends of the wires to be joined, are raised to and maintained at this temperature, and are kneaded together until a homogenous mass of metal has been produced at the point of contact. The interest in the various alloys of aluminum increases. In France "partinium" and "albradium" are expected to have a wide field of usefulness. Partinium is an alloy of aluminum and tungsten, and it is used in the motor car industry for portions of the structural work of the carriages. Albradium is an alloy containing copper, nickel, zinc, phosphorus and aluminum, and takes a polish equal to that of silver. Another series of alloys of the light metal made in France, contain tin, copper, zinc and aluminum. The specific gravities of these alloys vary between 2.8 and 7.1. The chief event in the calcium carbide industry has been the heavy fall in the selling price; the carbide factories cannot, in most cases, make any profit at this low price. This fall in price is, however, an undoubted gain to those interested in the acetylene lighting business, as it reduces by 30 to 50 per cent the cost of their raw material. There are already 34 central supply stations for acetylene gas in operation in Europe, and five in the United States. The use of the new illuminant for railway car lighting is rapidly extending in continental Europe. The consumption of carbide by the Prussian State Railway in 1900 for this purpose is estimated at 8000 tons. The number of the factories producing chlorates of potash and soda is 11, with a capacity of 40,000 hp. Two new improvements seem to be of importance. The addition of a small quantity of potassium chromate to the electrolytic cell greatly increases the yield of chlorate per horse-power-hour. By the use of a small quantity of alumina in the cell, in order to combine with the sodium hydrate as it forms at the cathode, the losses resulting from secondary electrolysis are reduced. The past year has been marked by a continuance of the high prices, first obtained in 1899, for all classes and brands of copper. The world's output of copper for 1900 will be greatly in excess of that for 1899, when 470,000 tons were produced. Of this total it is now estimated that 44 per cent is refined by electrolysis in the 42 refineries of the world. Only one—that at Papenburg in Germany—starts with the ore as raw material, the Hoepfner process being used. Some information is given regarding the electrolytic methods of producing hypochlorite of soda solutions for bleaching wood pulp and textile goods, which are making progress. —Lond. *Elec.*, Jan. 4.

Electrolytic Effects of Secondary Currents.—JOHNSON.—An investigation of the evolution of explosive gas at the submerged electrodes of the secondary circuit of an induction coil which is often assumed to be due to the alternate formation of hydrogen and oxygen at both electrodes, in accordance with the charge in the direction of the reduced current. He proves that while gas is evolved at both electrodes by the current induced at breaking, no gas is evolved by the current induced at making. He further found that the gas evolved at both electrodes is explosive, and that therefore both oxygen and hydrogen were evolved at both electrodes. The electrodes were platinum wires fused into thin glass tubes, and the electrolyte was either acidulated water or a solution of sugar and calcium nitrate. The fact is proved that the secondary current at break is alternating. The amount of gas evolved, as well as the maximum spark length in air, are inversely proportional to the square root of the capacity of the primary condenser, provided that the capacity is considerably above the capacity required for supressing the primary break-spark.—*Ann. der Physik*, Nov. 12, 1900; abstracted in Lond. *Elec.*, Jan. 4.

REFERENCE.

Pastes for Storage Battery Plates.—PETERS.—A very long abstract, with the tables of the German paper abstracted in the Digest, Sept. 1. —Lond. *Elec.*, Jan. 4.

UNITS. MEASUREMENTS AND INSTRUMENTS.

Phasemeters.—ARMAGNAT.—An abstract of a paper read before the Internat. Soc'y of Elec. in Paris on the phasemeters exhibited at the Exposition. He calls attention to the fact that the instruments thus called really measure different quantities. If pure sine waves are assumed, for the phase difference betwen two currents of the same period, or between e. m. f. and current of the same period, an exact and simple mathematical definition can be given by means of the time at which both waves have the maximum value. As is well known, the phase difference is of importance as the power is equal to the product of the effective e. m. f., the effective current and the cosine of phase difference. In this case the utility of a phasemeter giving direct the phase difference is evident. In practice, however, pure sine waves are scarce, and the wave form is often of a very complex form. The e. m. f. and the current also have different wave forms. In this case the phase difference can no longer be defined as before. If, then, the power is equal to the product of effective e. m. f., effective current, and a co-efficient which may be called power-factor, the phase difference can be defined as that angle, the cosine of which is the power-factor. Finally, a third definition is possible: If the current is decomposed into its two components, the current in phase with the e. m. f. and the wattless current, the phase difference is that angle, the sine of which is equal to the wattless current divided by the whole current. There are actually no apparatus giving the power-factor by a simple reading, but it can be found sufficiently accurately by three readings with a voltmeter, ammeter and wattmeter. All apparatus which have been proposed and which are exact for sine waves, must be used with caution for industrial currents, for the same current they may give correct readings for one value of the power-factor and wrong readings for other values. The phasemeters, properly so-called, at the exposition were those of Siemens & Halske, of Ricardo Arno, and of Hartmann and Braun. The apparatus of the General Electric Company, of Berlin, was an ammeter giving the wattless current. The Siemens' phasemeter for measuring phase differences of some seconds to 10 deg. is briefly described.—*L'Eclairage Elec.*, Dec. 22.

Fault-Finding on Tramway System.—JOHNSTON.—An illustrated description of a quick method for finding a fault on a tramway line. Fig. 1 shows a short tramway 2½ miles in length, with the feeder, trolley wire and pilot wires for testing, which go from the supply station to the bus-bars in the feeder pillars. In the supply station they go to a small double-pole multiple-way switch, to which is also connected a low-reading voltmeter, as shown in Fig. 2. The test is as follows: "Suppose a short circuit has developed. Change the throwover switch to down position, which will allow a limited amount of current to flow through the feeder, this current being controlled by the resistance that has been put in series with it. Then put the testing switch *D* in the position marked 1. By so doing you connect up the low-reading voltmeter between the pilot wires 1 and 2, in other words, you take the drop in volts between the feeder pillars. If you get the correct drop, which can be found by calculation or experiment (a record of which should be kept always at hand), the fault is at or further away from the supply station than feeder pillar No. 2. A similar test can be made between the other feeder pillars, and by that means the fault located, but another position should be shown on the switch *D* to enable the voltmeter to be put across between the positive bus-bar and feeder pillar No. 1, in case the feeder should break down between those two points. If this should occur, the position of the fault can be found as the total drop on this length is known, which we will call v_1; then if the drop found by the test when the fault is on it v_2, the distance of the fault

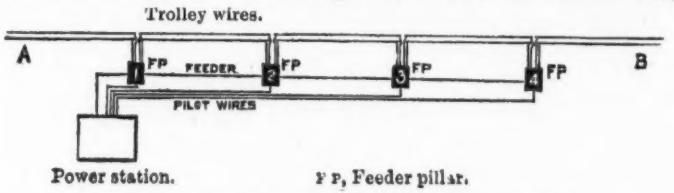


FIG. 1.—LOCATING FAULTS ON TRAMWAY SYSTEMS.

from the supply station will clearly be v_2L/v_1, where L is the total length of the cable under test. A fault often occurs which is not a "dead" short circuit, that is, it has in itself a certain amount of resistance to earth which may cut down the current below the standard amount allowed by the auxiliary resistance, and from which amount the calculations have been made. This, however, will introduce no error, for, suppose the fault was on the feeder between the supply station and feeder pillar No. 1, as in the last case, the position of the fault will be $(C_1v_2L)\div(C_2V_1)$ where C_1 is the standard current and C_2 the current going through the cable during test." — Lond. *Elec. Rev.*, Jan. 4.

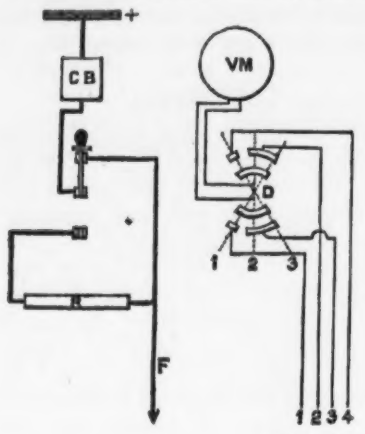


FIG. 2.—LOCATING FAULTS ON TRAMWAY SYSTEMS.

REFERENCE.

Phase-Turning Apparatus.—Campbell.—Hist. Brit. Phys. Soc'y paper in full on a phase-"turning" apparatus for use with electro-static voltmeters, an abstract of which was noticed in the Digest, Dec. 15.—Lond. *Elec.*, Jan. 4.

Telegraphy, Telephony and Signals.

Long Distance Telephony.—The first part of a serial referring to Pupin's system. In discussing the transmission of electrical disturbances over telegraph and telephone lines, the disturbance at the sending end is resolved into a group of harmonics of different periods, the problem is treated as if each of these harmonics was transmitted quite independently. This assumption that harmonics of different periods do not interfere with one another, is said to lead to correct results in the case of copper wires suspended in air, "but where solid dielectrics or iron form part of the system, as in the case of a submarine cable, it appears to be very doubtful"; the results obtained by Squier and Crehore on the Commercial cable "do not seem capable of explanation if harmonics are transmitted quite independently." The case of a twin line is analytically treated, and three special cases are briefly considered: First, there is no leakage, and induction coils are inserted in the line, according to Pupin; second, there is non-inductive leakage to give Heaviside's distortionless circuit; third, inductive leakage is applied to a line whose inductance is small, this is the basis of S. P. Thompson's proposal.—Lond. *Elec. Rev.*, Jan. 4.

REFERENCE.

Statistical.—The conclusion of the long statistical article on telegraphy and telephony in France, also statistical articles on telegraphy and telephony in British India in 1898-99, and on telegraphy in New Zealand in 1899.—*Jour. Teleg.*, Dec. 25.

Miscellaneous.

REFERENCES.

New Century Reviews.—Quite a number of illustrated reviews, among which there are the following: Child, The First Century of Electricity; Maver: The Telegraph in the Ninteenth Century; Sprague: Historical Notes on Electric Traction; Maxwell: Electromobile Evolution; Maynard: Development of the Telephone; an interview with Edison on the starting of the Pearl Street station in New York, and on his inventions; Trowbridge: Wireless Telegraphy and the Earth; Weeks: A Review of the History of Electric Lighting; Caldwell: History of the X-Rays; Stillwell: Electric Power Transmission.—*Elec. Rev.*, Jan. 12.

Metal Market.—Diagrams showing the fluctuations of the price of zinc, lead, iron, tin and copper for December. Such diagrams are published in that journal in the first number of every month, and will not again be noticed here.—Lond. *Elec. Rev.*, Jan. 4.

New Books.

Theorie und Praxis der Analytischen Elektrolyse der Metalle. Von Dr. Bernhard Neumann. Halle: Wilhelm Knapp. 224 pages, 65 illustrations. Price, 7 marks.

This book is intended to be a practical book explaining the application of electrolysis to analytical purposes, and describing the electrolytic methods which have been found useful in practice for the estimation of metals. The author has taken great care to give a very exact description of the special conditions of the tests, such as voltage, current density, temperature, concentration, etc. He deals first with the electrolysis of a pure metallic salt solution, then with the electrolysis of a solution of several salts, and gives finally practical applications of electrolytic methods for tests of alloys, ores, etc. Although the book is thus a practical book for the engineer, it is pleasing to see that the theoretical parts are all fully up-to-date, and based entirely upon modern views of electrolysis. A rather long and well-written introductory chapter is devoted to a summary of these views.

BOOKS RECEIVED.

An Introduction to Modern Scientific Chemistry. By Dr. Lassar-Cohn. Translated by M. M. Patteson-Muir, M. A. New York: D. Van Nostrand Company. 348 pages, 58 illustrations. Price, $2.00.

The Coal and Metal Miners' Pocketbook. Principles, Rules and Tables. Sixth edition, revised and enlarged. Scranton: The Colliery Engineer Company. 637 pages. Illustrated.

Exhibits at the Milwaukee Convention.

A report of the proceedings at the Milwaukee Convention of the Northwestern Electrical Association appears elsewhere in this issue. There was a good display of exhibits and gathering of commercial interests, as will be seen from the subjoined notes:

The Illinois Electric Company, Chicago, was represented by Mr. C. W. Bacon.

Macomber-Whyte Rope Company, Chicago, was represented by Mr. George Whyte.

Evans, Almira & Co., Chicago, Ills., were represented by F. N. Jewett, Western agent.

The Electric Vehicle Company, of New York, was represented by Mr. Joseph M. Hill.

Triumph Electric Company, of Cincinnati, Ohio, was represented by Mr. J. Holt Gates.

John A. Roebling's Sons Company, of Trenton, N. J., was represented by Mr. M. B. Kitt.

The Standard Carbon Company, of Cleveland, Ohio, was represented by Mr. William O'Connor.

Munsell & Co., of New York, were represented by their Chicago manager, Mr. Charles E. Coleman.

Warren Electric Manufacturing Company, of Sandusky, Ohio, was represented by Mr. J. Holt Gates.

Chicago Edison Company had its interest well taken care of by its purchasing agent, Mr. Charles Holmes.

O. C. Little Pulley Coating Company, of Menasha, Wis., was in charge of its president, Mr. O. C. Little.

The Hart & Hegeman Company and Peru Electric Company were well represented by Mr. George B. Searing.

The Edward P. Allis Company, of Milwaukee, Wis., was represented by its traffic manager, Mr. David Harlowe.

The Chicago Belting Company, of Chicago, was represented by Mr. Ed. H. Ball, treasurer, and Mr. E. T. Toogood.

The American Electric Works, of Providence, R. I., were represented by their Western manager, Mr. F. E. Donohoe.

American Steel & Wire Company, Chicago, was represented by the manager of its electrical department, Mr. E. J. Pietzeker.

The National Carbon Company, of Cleveland, Ohio, had its popular Chicago salesman, Mr. Richard O'Connor, in charge.

Cutler-Hammer Manufacturing Company, Milwaukee, Wis., was charmingly represented by its officials, Messrs. Bacon and Hickcox.

Electric Appliance Company, Chicago, was represented by its president, Mr. W. W. Lowe, assisted by Mr. W. P. Upham, S. A. Rall and B. B. Downs.

The New York Insulated Wire Company, New York, had its interests taken care of by its well-known and popular convention favorite, Mr. James Wolff.

The Buckeye Electric Company and the Jandus Electric Company, of Cleveland, Ohio, were represented by their Western manager, Mr. Joseph H. Cook.

THE AMERICAN CIRCULAR LOOM COMPANY was represented by Mr. H. B. Kirkland, the general sales manager, and Mr. Thomas G. Grier, Western manager.

ILLINOIS MAINTENANCE COMPANY, Chicago, was effectively represented by its president, Mr. E. H. Cheney, who was most thoroughly welcomed by his many friends.

THE COLUMBIA INCANDESCENT LAMP COMPANY, St. Louis, was represented by the manager of its Northwestern office, at Minneapolis, Minn., Mr. James B. Coale.

DEARBORN DRUG & CHEMICAL WORKS, Chicago, were represented by its Milwaukee manager, Mr. J. W. Harkins, who presented some very attractive and useful souvenirs to all callers.

CHICAGO MICA & INSULATION COMPANY, of Valparaiso, Ind., was represented by its vice-president, Mr. Charles W. Cobb. Mr. Cobb closed one of the largest deals during the convention.

THE ADAMS-BAGNALL ELECTRIC COMPANY, Cleveland, Ohio, was well represented by its Chicago Western sales manager, Mr. J. G. Pomeroy, one of the most popular gentlemen attending the convention.

THE WAGNER ELECTRIC MANUFACTURING COMPANY, St. Louis, exhibited a new style of transformer, which attracted a great deal of attention. The exhibit was in charge of its Western manager, Mr. George B. Foster, assisted by Mr. J. F. Begole.

GEORGE CUTTER COMPANY, Chicago, was represented by its president, Mr. George Cutter, whose watchword was "Why Don't That Lamp Drop?" His many friends can receive an answer to this by enclosing a 2-cent stamp when writing to the above.

WESTERN ELECTRIC COMPANY, Chicago, exhibited an interesting display of arc and incandescent lamps, also ceiling and desk fan-motors. The company was represented by Messrs. A. L. Tucker, Irving Jackson, E. P. Warner and Fred Basedow.

THE CHRISTENSEN ENGINEERING COMPANY, of Milwaukee, was most effectively represented by its sales manager, Mr. George J. Cadwell. As Mr. Cadwell had just been appointed to this position, he was receiving congratulations from his many friends during the meeting.

THE NORTHERN ELECTRIC MANUFACTURING COMPANY, Madison, Wis., was well looked after by Mr. D. E. Goe. This gentleman has been a familiar figure amongst the electrical fraternity for a number of years, and his many friends were delighted to see him on the war-path once again.

GENERAL INCANDESCENT ARC LIGHT COMPANY, of New York, was ably taken care of by its popular Western sales manager, Mr. Francis Raymond, who was well assisted by its Milwaukee representative, Mr. Thomas James. It had an exhibit of many lines, which were attractive and interesting.

THE GREGORY ELECTRIC COMPANY, Chicago, was represented by its general manager, Mr. Louis A. Kuehmsted, assisted by Mr. R. H. Watson. The "Bargain House" of America was referred to by all present. They entertained sumptuously, and their very handsome and attractive souvenirs were in great demand.

THE MILWAUKEE ELECTRIC COMPANY, of Milwaukee, Wis., was represented by its vice-president, Mr. Walter Cary, assisted by Mr. I. B. Cary and Mr. W. H. Perry. They exhibited a very handsome line of motors, which attracted much attention, particularly a special 6-pole S. P. motor for direct-current fans and printing machines.

M. B. AUSTIN & Co., Chicago, were represented by their president, Mr. M. B. Austin, and vice-president, Mr. W. A. Brown, assisted by Mr. A. H. Friend, C. N. Jackson, C. A. Robinson, A. Meinuna. Mr. Edward Belden also assisted in the arc lamp department. Their exhibits consisted of Belden arc lamps, Dayton fans, Safety wires and cables, and other electrical specialties.

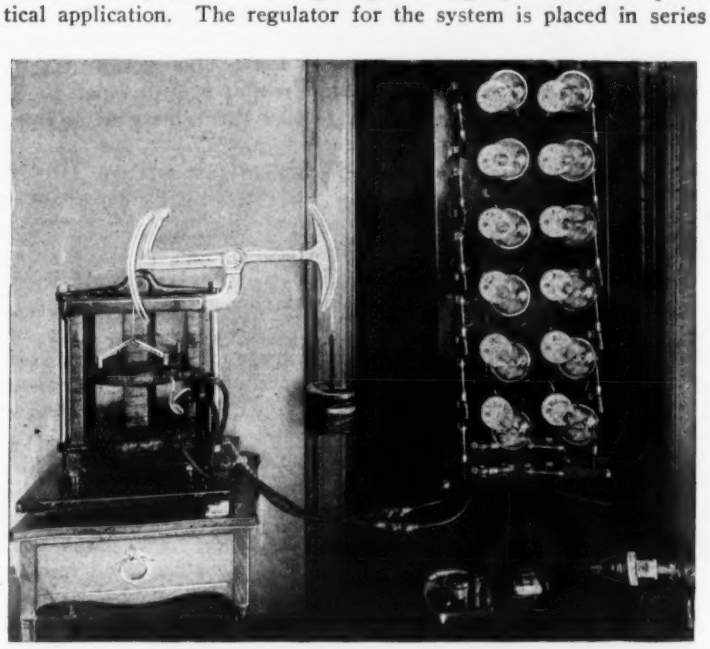
THE SAWYER-MAN ELECTRIC COMPANY had an attractive exhibit of incandescent lamps. It also had a complete photometer outfit, by which it was able to give convincing proof of the efficiency of these lamps. The Westinghouse Electric sign was equipped with Sawyer-Man lamps. The gentlemen in charge of this exihibt were Mr. C. A. Ross, manager of the Chicago office, and Mr. R. S. Mueller.

THE RICHMONDT CONDUIT COMPANY, Milwaukee, attractively exhibited a sample of its electro-galvanized interior and exterior reamed conduit, especially designed for interior work in fireproof buildings. This company is building a large factory 85 ft. wide, 400 ft. long and 35 ft. high, and will install a 150-hp engine. It has booked orders for about 2,000,000 ft. of conduit, and the new factory will give it a very large capacity. This company will also erect a plant in Canada for the Canadian trade, which will be in operation in about two months. Mr. Richmondt was in charge of this exhibit.

MCROY CLAY WORKS, of New York, were represented by Mr. E. F. Kirkpatrick, or "Kirk," as he is familiarly known, in charge of the exhibit. "Kirk" had a surprise in store for his electrical friends. The sign on his door read, "McRoy Clay Works, vitrified conduits, E. F. Kirkpatrick, Western manager." This necessitated many explanations, as Mr. Kirkpatrick has only just been appointed to this position. Mr. Kirkpatrick has been identified for the past 15 years with the Westinghouse, Fort Wayne and General Electric Companies, and his many friends congratulate the McRoy Clay Works in securing his services.

THE BROWNING MANUFACTURING COMPANY, of Milwaukee, had an unusually attractive exhibit of motors, ranging in size from 1-12 hp to 3½ hp. This concern is rapidly coming to the front as a manufacturer of strictly high-grade direct-current motors, and also makes a specialty of slow-speed motors, for special purposes, and its output is in general demand. The finish of its product is very artistic, and nothing but the best of material and workmanship enter into its construction. The exhibit was in charge of its president, Mr. Howard L. Browning, assisted by its secretary and treasurer, Mr. William Stark Smith.

THE GENERAL ELECTRIC COMPANY was to be found at the old stand. This company was represented by the following gentlemen, who attended to the wants of their many customers: Mr. B. E. Sunney, general Western manager; Mr. F. N. Boyer, manager supply department, Chicago office; Messrs. L. G. Crawford, J. Scribner, S. F. Dibble and Thomas Ferris, of Milwuakee; F. G. Vaughn and P. D. Wagner, of Schenectady. The General Electric Company's exhibit was unusually interesting to the electrical fraternity, and comprised many new and interesting pieces of apparatus. Probably the most interesting new device exhibited at the convention was a new method of controlling series incandescent lamps for street lighting. This system is similar in principle to the well-known constant-current transformer system for arc lighting, but slightly different in practical application. The regulator for the system is placed in series



METHOD OF CONTROL OF SERIES INCANDESCENT STREET LAMPS.

with the line, and one point in which this method of control is superior to all others is that the regulation is automatic. This is a most important consideration on such a system. The efficiency is remarkably high, there being only 131 watts copper loss, and no core loss on a coil at full load for 3000 volts at 3½-ampere circuit. At position of no-load the losses would be core loss 130 watts, and copper loss 131 watts. At full load, the power factor is approximately 98 per cent.

These coils have been in use for about a year, but have not been pushed, as it was the desire of the General Electric Company to obtain results of practical operation before pushing the sale of these coils. About 50 coils are now in use or on order.

The Westinghouse Electric & Manufacturing Company, presented a detail exhibit of apparatus, consisting of a Westinghouse wattmeter, which was shown in operation in connection with suitable switchboard instruments, particular attention being called to the company's new line of long-scale indicating instruments. It also exhibited its types of lightning arresters, fan motors, cut-outs, etc. A prominent feature of the exhibit was the new "O.D." type transformer, which represents the most modern practice in its details of construction. A large electric sign, suspended across the west end of the hall, bore the name of Westinghouse. The officials representing the company during the convention were W. R. Pinckard, C. C. Burton, T. P. Gaylord, W. S. Rugg and Ervin Dryer. Mr. Arthur Hartwell, manager of the Chicago office, was expected to be present, but was detained by matters of greater importance.

The Fort Wayne Electric Works, of Fort Wayne, Ind., were, as usual, represented by their well-known salesmen, Messrs. Willard Knight and Frank McMaster. Mr. King, head of the meter department, was also on hand to explain the details of the type "K" meter, which attracted a great deal of attention, owing to its many novel but practical features, such as absolute interchangeability of all parts. The entirely new features of adjustment in this meter caused a great deal of interest, and Mr. King received a great deal of praise. Mr. Edward A. Wagner was also on hand to show up the leading features of the new type "A" transformers, which also have some entirely new and useful features. They also exhibited a 5-hp Wood automatic starting box, with over-load and under-load release. The simplicity and ingenuity of the little device made it particularly attractive to those operating motors, as it is practically impossible to burn out a motor, when using this device.

Double Wound Armature Motors.

The use of motors having an armature with two independent windings is not new in European practice, particularly for automobile work. The great advantage of this system for variable speeds is evident, since it permits variations in speed to be obtained without the waste of energy involved in the rheostatic method of control. The C & C Electric Company has adopted a double-wound armature system in the manufacture of motors for certain classes of work, in connection with a very complete system of control which its engineers have devised and which formed the subject of a patent granted last year.

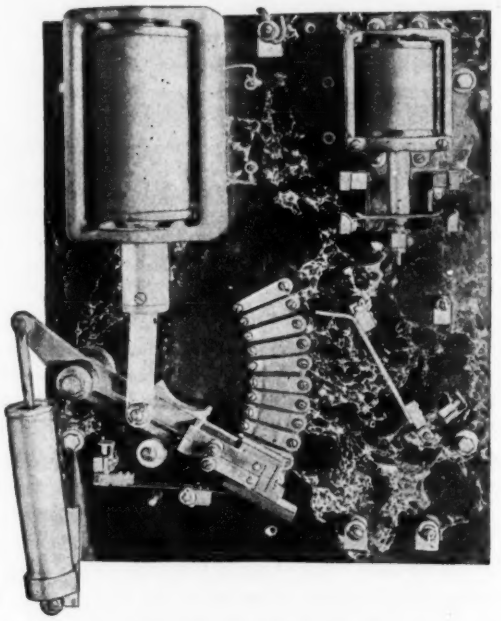
The controlling apparatus is arranged in two sections. One of these is operated by the motorman in starting, stopping and changing plates and buttons, a hand lever centrally pivoted with respect to these is operated by the motorman in starting, stopping and changing speed. The second portion of the controlling apparatus consists of an arrangement of solenoids whereby the motor is started or stopped, and the armature windings thrown into series or parallel. The contacts of the controller panel connect with the motor series and shunt fields, with resistances to be thrown in and out of the armature and field circuits and with the solenoidal switches. As the hand lever is moved along, a contact is made which causes the solenoids to throw the armature windings in series and into circuit. Further motion of the lever cuts resistance out of the armature circuit. Part of the series windings of the field are short-circuited at ensuing contacts, and further movement short-circuits the remainder of the series windings, the motor then running as a plain shunt machine with the armature windings in series and without external resistance. The next motion of the lever makes a contact which causes the solenoids to throw the two independent winding armatures in parallel with resistance inserted, and still further motion cuts out all the resistance. By means of the final contacts resistance is thrown into the shunt field, thereby increasing the speed. By means of the various combinations described, the speed of a motor may be gradually increased from, say, 20 r. p. m., to a final speed of 400 r. p. m. One of the incidental advantages of this system is that by means of push-buttons located at any desired number of points, a motor may be cut out of circuit, the push-button not being in the main circuit but acting on the stopping solenoid.

The most obvious application of this type of motor is to printing presses, where a considerable range of low speeds and quick control are absolutely essential. Still other applications are in paper making rolls, certain machine tools, grinding and polishing tables—in fact, wherever large starting torque, considerable speed variation and quick control are requisites. It is customary to lay stress upon the word "flexibility" in speaking of the advantages of the alternating current, but the present system is an illustration of the great capabilities of the direct-current in flexibility of motor speed which will always retain for it supremacy in that field.

C. & H. Self-Starter.

The device illustrated herewith is designed to start and stop an electric motor automatically. It is made in two styles, one being adapted for the control of motor-driven pumps, which can be automatically started and stopped by means of either a float switch or a pressure regulator. The same style is also adapted for operating what are known as double-belt elevators, which are driven by a non-reversing starter. The other style is designed for use with reversing motors. Arcing on the main switch is taken care of by powerful blow-out magnets behind an independent solenoid-controlled switch.

This starter consists of a pivoted lever which holds renewable carbon brushes moved over renewable copper segments by means of a powerful solenoid. An oil dash-pot retards the movement of the lever, the speed of which can be regulated by varying the consistency of the liquid in the dash-pot. The smaller solenoid located in the upper right-hand corner carries a carbon-tipped switch, whose purpose is to close the main-line circuit and start the motor. The circuit which includes the winding of this solenoid is closed and opened by means of a float switch, pressure regulator, reversing switch or other device, according to the use to which the starter is applied. The closing of this solenoid-controlled switch not only



AUTOMATIC MOTOR-STARTER.

closes the circuit of the motor through the resistance of the starter, but also closes the circuit which includes the winding of the large solenoid. The lever of the main rheostat slowly moves over the segments, thereby gradually cutting out all of the external resistance in series with the armature, and also strikes the smaller lever shown at the right of the middle of the cut. The latter lever is moved so as to introduce an incandescent lamp in series with the winding of the main solenoid. The resistance of this lamp prevents the winding from overheating, and also serves as a pilot lamp, indicating whether or not the main solenoid is receiving the proper amount of current.

The small carbon-tipped switch in the lower left-hand corner is so arranged that when the main lever is at its lowest position, as shown, the two small carbons will be pressed together. The moment the rheostat lever starts to lift, these carbons separate and insert the resistance of another incandescent lamp in series with the winding of the smaller solenoid, thereby preventing the latter from overheating, and also providing other safeguards in the operation of the device.

This starter is manufactured by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

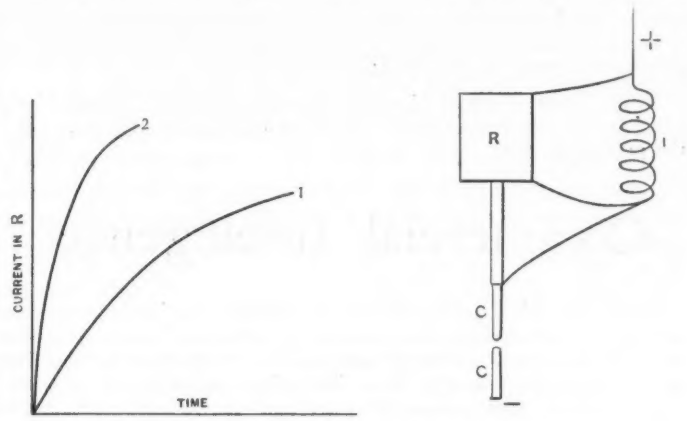
The Helios-Upton Continental Arc Lamp.

Central station managers who have arc lamps on constant potential continuous-current circuits will be interested in an improvement in enclosed lamps, which is claimed to accomplish by remarkably simple means, some greatly desired results; among others, making the arc "strong" and "tough," to use the language of arc lamp makers; enabling the resistance in series with the arc to be greatly reduced, thereby reducing the usual dead losses, and at the same time enabling arc lamps to be run with greatly reduced currents, as small even as 1½ amperes. This latter improvement has been very greatly desired for a long time, but the fact that few if any of such small current lamps have been in use, shows that this problem had not before been solved in a satisfactory way. Moreover, the addition of this new and simple improvement enables the amount of light given out for the same current to be increased, or what is the same thing, the same amount of light can be obtained with less current—a very important matter for central station managers.

Claims are often made by inventors for their devices which frequently are not substantiated by practical tests. In this case, however, the lamp has passed through this trying test, it being stated that several thousand are already in practical use, and thus any one can satisfy himself about the claims made. Not the least interesting feature is the great simplicity of the device, which consists simply in connecting in parallel to part of the series regulating coil, a self-induction coil, which, as is described below, tends to regulate the arc before instead of after a change of current in the arc takes place, thus anticipating, as it were, any change of current. This prevents the very objectionable pumping or surging which is often seen when one tries to accomplish the same result by other means. This improvement is claimed to be for arc lamps what the Nernst lamp is for incandescent lamps.

This new lamp, which is now being put into the market by the Helios-Upton Company, of Philadelphia, and is called the Continental arc lamp, is of the enclosed type, and is for use on direct-current constant potential circuits. The higher economy is obtained by a regulating mechanism which dispenses with the use of "dead resistance" in series with the arc when the lamps are connected across constant potential circuits.

It is well known that the e. m. f. required to sustain an electric arc of a given length is smaller the greater the current. This is the reason why it is impossible to supply an arc of given length directly from constant-potential mains. It would, however, be possible to do so if by



CURVES AND DIAGRAM OF LAMP CONNECTIONS.

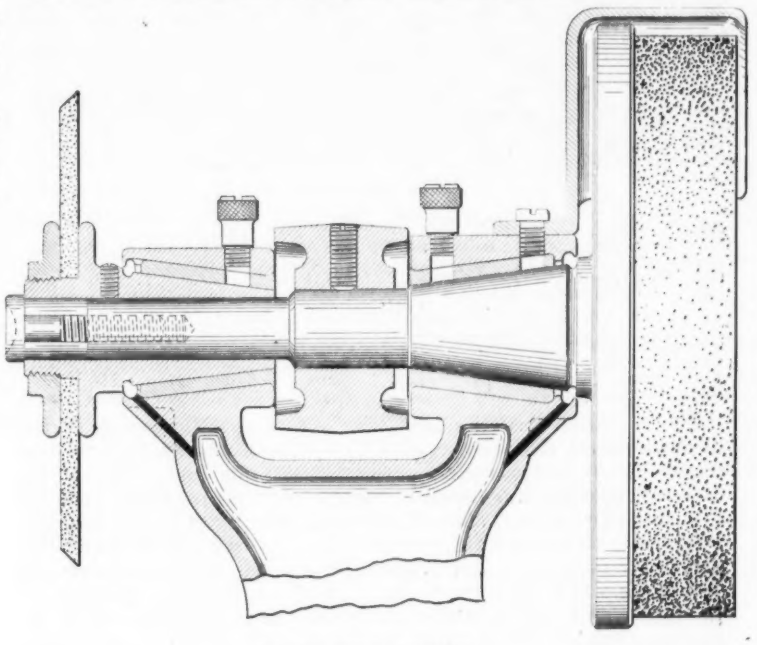
a regulating mechanism the potential of the arc could be made to rise with increase of current and fall with decrease of current, by lengthening and shortening the arc. The practical difficulty which has so far prevented the use of this method is that the regulating mechanism lags behind in time in its action, so that stability is lacking. It is well known that in practice a stable condition is obtained by using a dead resistance in series with one or more arc lamps across the line, which is open to the objection that the resistance consumes energy.

In the Continental lamp of the Helios-Upton Company, no dead resistance is employed, but use is made of a regulating mechanism of the kind mentioned above, and the practical difficulty noted above is overcome in an interesting and ingenious way, which is roughly illustrated herewith. *C* and *C* are the carbons. *R* is the electromagnetic device controlling the motion of the upper carbon. *I* is a self-induction coil. *R* and *I* are in parallel with each other, but in series with the arc. *I* has a high self-induction, while *R* has not. Then if, for instance, there is a tendency to an increase of current, it will rise more rapidly in the resistance *R* than it would without the reactance. If the current in *R* varies like curve 1 when no reactance coil is used, it will vary like curve 2 when the reactance coil is added in parallel. This means that the regulating mechanism shortens or lengthens the arc in time to prevent any pumping. In a lamp connected across 110-volt mains the current was 4½ amperes, the e. m. f. at the terminals of the arc itself was 95 volts and the arc burned very steadily. It will thus be seen that of the 495 watts supplied from the mains, as much as 428 watts are consumed in the arc itself.

There is claimed to be a gain of light with this lamp for two reasons: More watts are consumed in the arc itself than with the use of a dead resistance, and the arc is longer, so that less light is hidden by the tip of the lower carbon. The same amount of light is thus obtained with less current. Moreover, the lamp burns steadier, and well-regulating lamps are made for currents as small as 1½ amperes.

Improved Twist Drill Grinder.

The accompanying illustration shows the improved form of bearings adopted for the American twist drill grinder built by L. S. Heald & Son, Barre, Mass. The machine was formerly constructed with a long, straight taper bearing, having the pulley at the small end, and to adjust for wear the arbor was drawn into the bearing by the adjusting screw outside the pulley. In the new construction, as will be seen in the cut, the arbor is turned with a sufficiently steep taper at the end, which carries the principal wheel, this taper journal running in a babbitted bearing. The arbor is then turned straight for the fit of the driving pulley, and then smaller for the other end, on which is a snugly fitted sleeve with the outside made of a similar taper to the one forming the other journal of the arbor, and this carries on its outer end a thin and light emery wheel when desired, as shown.



TWIST DRILL GRINDER.

The sleeve is adjusted by the central screw tapped into the end of the arbor, and is secured by a small headless screw at the side. This adjustment, it will be seen, provides for the fit of both journals, and for the end thrust. The bearings are provided at the outer ends with oil channels, and at the inner ends with suitable self-closing dust-proof oil covers, so that the lubrication of the entire journal surface is assured.

This arrangement of two bearings adjustable toward each other makes a superior construction to the old style single taper. The emery wheel consists of a ring of emery 8½ in. in diameter, with a 6-in. hole, and is threaded into the wheel chuck by the use of a ring of soft metal. A safety chuck is thus provided, and the entire wheel may be used up in service. The thin emery wheel on the other end is furnished when desired, and is found very convenient for thinning the points of drills when they are worn back and the center becomes thicker.

NEWS OF THE WEEK.

Financial Intelligence.

THE WEEK IN WALL STREET.—Money on call closed 2½ per cent, nominally. Time money was easier, the supply exceeding the demand. Rates are 3½ per cent for thirty days, 3¾@4 for sixty days to six months. Mercantile paper was active, the demand, especially that from out of town, having broadened. The closing rates were 3½@4 per cent for sixty to ninety days' endorsements, 3¾@4¼ for choice 4 to 6 months single names, and 5@5½ for others. In the stock market reactionary influences were in evidence, and there was a general decline in prices under both heavy liquidation and selling for short account. The downward movement extended to the tractions and electrics, the heaviest declines in these being 11⅜ points in Brooklyn Rapid Transit; 4 in General Electric; 11⅛ in Metropolitan Street Railway, and 5½ in Western Union. Manhattan had a sharp advance early in the week, accompanied by the perennial report connecting it with Metropolitan's interests, but the customary denial knocked the price down again and the stock closed at 112—a net loss of 9¾ points. The market for outside securities was characterized by sharp declines and generally lower bids of security values. Among the principal declines were Electric Vehicle pfd. 5 points and General Carriage 1 point. Electric Vehicle on Thursday broke to 3 per share, accompanied by a rumor of another assessment on the stock. Following are the closing quotations at the four centres named:

NEW YORK.

	Jan. 12.	Jan. 19.		Jan. 12.	Jan. 19.
Gen. Elec.	190	186	Elec. Veh.	16	15
Bklyn. Rap. Tran.	86¾	75⅜	Elec. Veh., pfd.	35	35
Met. St. Ry.	170⅞	159¾	Gen. Car.	3¼	2¼
Am. Tel. & C.	93	—	Ill. Elec. Veh. Tran.	¾	¼
West. Un. Tel.	86¾	81¼	N. E. Elec. Veh. Tran.	3¼	3
Am. Dist. Tel.	30	—	N. Y. Elec. Veh. Tran.	4¾	4¼
Com. Cable	165	—	Tel. & Tel. Co. of Am.	4¾	4½
Elec. Boat.	27	28	Hud. Riv. Tel.	116	116
Elec. Boat, pfd.	49	50	N. Y. & N. J. Tel.	174	174

BOSTON.

	Jan. 12.	Jan. 19.		Jan. 12.	Jan. 19.
New Eng. Tel.	129¾	—	Erie Tel.	53	65
Mex. Tel.	2¾	—	Gen. Elec., pfd.	—	—
Westing. Elec.	56	—	Am. Tel. & Tel.	163	157
Westing. Elec., pfd.	67	—	Boston Elec. Light	—	205

PHILADELPHIA.

	Jan. 12	Jan. 19.		Jan. 12.	Jan. 19.
Elec. Stor. Bat.	78	78	Phil. Elec.	5⅞	6
Elec. Stor. Bat., pfd.	80	80	Pa. Elec. Veh.	2	2
Elec. Co. of Am.	9¾	9	Pa. Elec. Veh., pfd.	1	1
Gen. Elec. Auto.	—	—	Am. Rys.	32½	33¼

CHICAGO.

	Jan. 12.	Jan. 19.		Jan. 12.	Jan. 19.
Chicago Edison	150	151	Chicago Telep. Co.	245	253
Chic. City Ry.	255	253	Union Traction	12	12
Nat'l Carbon	16	15¾	Union Traction, pfd.	48½	49
Nat'l Carbon, pfd.	83	83	Northwest Elev. Com.	28¾	27

ERIE TELEPHONE CHANGES.—At a special meeting of the directors of the Erie Telegraph & Telephone Company, held in Boston on Jan. 17, the new management, representing the bankers' syndicate, took charge of the company's offices. Charles J. Glidden resigned the office of president, but will remain a director. Charles A. Grant resigned as treasurer. Mr. Glidden's position was not filled, and will not be for the present, but Walter Abbott was chosen treasurer, and Mr. Grant was made auditor. An executive committee, consisting of the following named gentlemen, who will, for the present at least, direct the affairs of the company, was appointed: Philip Dexter, chairman; William Endicott, Jr., Reginald Foster, Francis R. Hart and W. J. Latta. These changes are acknowledged to be in accord with the plans that the new management of the corporation has arranged, and are a part of a broad scheme which will, it is believed, ultimately result in the absorption of this great property by the American Telephone & Telegraph (Bell) Company. Under agreement with the Old Colony Trust Company, the officers of the Erie Company agree to keep the Cleveland, Northwestern, and Southwestern companies absolutely free from debt, and that they will do nothing in the management of the subsidiary companies to in any way impair the value of their stocks, which are collateral to the Erie bond issues. Mr. Glidden asserts that the decline in Erie was aided by a powerful bear clique in New York which sold large blocks of stock short. He says the Erie Telephone Company will earn $5,000,000 gross in 1900, an increase of $1,200,000 over 1899, and he looks for an increase of $500,000 to $750,000 in 1901.

AMERICAN BELL TELEPHONE.—The opinion seems to be general in Boston, says the *Boston News Bureau*, that the Erie Telephone Company will ultimately lodge within the control of the American Telephone Company, and that the failure of the Telephone, Telegraph & Cable Company to finance the company's expanding business, means the utter collapse of the independent telephone movement. A prominent Erie Telephone man says that in any absorption of the Erie Telephone Company by the Bell people, the trade would probably be made on the basis of two shares of Erie for one of the American Telephone Company. A gentleman at the head of one of the large telephone corporations operated by the Bell people said in discussing the Erie Telephone situation: "The trouble with the telephone business throughout the country is that the demand for services exceeds the supply of capital. The question is a vital one and must be met on a broad and elaborate plan if the position of the Bell companies is to be maintained. The development of telephone exchanges must continue and new business be obtained; otherwise the death of subscribers, failures, removal of, and discontinuance of instruments would soon impair the service and reduce its value greatly."

NEW YORK ELECTRIC VEHICLE TRANSPORTATION.—Reports have been current lately that on account of the extensive new work described in these pages an assessment would be called on the stock of the New York Transportation Company. The rumor has been denied, but within the last few days has been revived, and been followed by marked weakness in the company's stock. A member of the executive committee of the company states that such a thing as calling for a further payment had not been considered. The company, he said, has in bank $480,000 which will not be needed for a long time to come, and has in operation 300 vehicles which are now being run at a slight profit, so that the company is no longer losing money on operation, which was the case during the time it was engaged in the preliminary establishment of its business. In addition to these assets the company owns unincumbered the Fifth Avenue stage line, which is deemed a valuable property, and for which the New York Transportation Company has received and refused large cash offers.

NATIONAL LEAD.—The sharp decline in National Lead stock is said to be largely due to the competition of the Electrical Lead Reduction Company, whose new factory has recently started at Niagara Falls, and whose quick electrical processes of converting lead ore into the various lead compounds threaten to revolutionize the old and present methods of manufacture. Note of the new process, etc., was made recently in these pages.

GENERAL ELECTRIC.—The recent advance in General Electric to 200 has naturally resulted in the exchange of stock for the 5 per cent debenture bonds. To date about $3,600,000 bonds have been surrendered, leaving $1,700,000 outstanding.

NATIONAL CARBON.—The directors of the National Carbon Co. have declared the regular quarterly dividend of 1¾ per cent on the preferred stock.

Commercial Intelligence.

THE WEEK IN TRADE.—The general condition of trade, as indicated by reports to the mercantile agencies, has a satisfactory and hopeful aspect, although nothing of a startling or extraordinary nature transpired in any line. The chief interest just now is in iron and steel, arising from the reports of the past few days regarding probable aggressive competition. *Bradstreet's* says that trade on Spring account has, on the whole, improved. The great speculative staples are lower and transactions are smaller, but there is more doing in Spring business by Eastern jobbers. Southern and Southwestern trade is opening up satisfactorily and the Northwest reports a better outlook for Spring business. Conditions as to retail distribution are not quite so favorable. The open season, however, has helped the distribution of hardware; lumber is more active in the West, and in the East wholesalers have done more business, but export trade in this line lags. December gross railroad earnings gained 9 per cent over December, 1899, and closed a year which has certainly been the best in the history of American railroads. The earnings of 109 roads for the full calendar year 1900 aggregate $759,291,615, a gain of about 10 per cent over 1899. Copper was extremely dull and inactive. The official quotations of the New York Metal Exchange are 17c. for Lake and 16⅝c. for electroyltic. As regards steel rails the *Iron Trade Review* says: "The rail mills have booked a fair amount of business since the year opened, electric lines in the Central West contributing some good orders. In the Chicago district a 20,000-ton contract for export was

booked in the week. The announcement that prices on rails would be withdrawn on Jan. 15, may have hastened some buying, but there is still skepticism concerning the reported purpose of the pool to make a $2 advance with Feb. 1. Mills in all districts are fully occupied, and none are pushing for business."

THE JAPANESE GOVERNMENT ARSENALS at Tokio and Osaka are about to be equipped with American electrical machinery, etc., the placing of the contracts for which have just been determined upon. It is a matter of congratulation to manufacturers in the United States that, despite the severest competition which was presented by English, German and other European concerns, contracts for everything foreign which the specifications requisitioned for, are being placed in this country. As regards the Tokio Arsenal, the most important contract has been secured by the Westinghouse Electric & Manufacturing Company, of Pittsburg. This concern will furnish three direct connected 250-kw generators, two 100-hp motors, one 75-hp motor, two 50-hp motors, two 30-hp motors, and one 15-hp motor; large switchboard for central plant and a number of transformers, etc. The engines, of which there will be three vertical cross compound ones of 350-hp each, will be built by McIntosh & Seymour, of Auburn, N. Y. The Westinghouse people are to furnish two 200-kw generators and a number of motors which will be installed in the Osaka Arsenal. The Morgan Engineering Company, of Alliance, Ohio, will undertake the building of six electric cranes which are to be erected in the new machine shops and foundry of the same arsenal. These equipments will vary in capacity from 10 tons to 25 tons. The following firms are among the successful bidders for the supplying of machine tools, which are to be driven by the Westinghouse motors: Pratt & Whitney, of Hartford, Ct.; Prentice Bros., of Worcester, and the Becker-Brainard Milling Machine Company, of Hyde Park, Mass.; Wm. Sellers & Co., of Philadelphia, Pa.; also the American Tool Works, J. A. Fay & Egan Company, and the Cincinnati Milling Machine Company, of Cincinnati, Ohio. All the above mentioned contracts were secured through the New York office of the Japanese house of Takata & Co.

THE I. P. MORRIS COMPANY, of Philadelphia, Pa., has been awarded a contract for six new 5000 horse-power turbines by the Niagara Falls Power Company. The new turbines are to be built after designs prepared by Escher, Wyss & Co., of Zurich, Switzerland, and will differ from the turbines now in use, principally by the guides and buckets being enclosed in the wheel case and having draft tubes which will allow the utilization of the full head of water available. The turbines now in use in the present wheel-pit were designed by Picard, Pictet & Co., of Geneva, Switzerland. About a year ago Dr. Coleman Sellers and William A. Brackenridge, of the Niagara Falls Power Company, visited Geneva, Switzerland, and on their return last Spring, the Niagara Falls Power Company invited competitive plans from Escher, Wyss & Co., of Zurich, which have now been accepted. When the new turbines are installed they will be placed in the new wheel-pit to drive the six 5000 generators ordered last November from the General Electric Company, of Schenectady. It is expected that the I. P. Morris Company will deliver the new turbines in August of the present year. Clemens Herschel is the consulting hydraulic engineer of the Niagara Falls Power Company.

SPRAGUE COMPANY IN THE SOUTH.—With the beginning of the new century, the Sprague Electric Company opened another branch office to facilitate the handling of its constantly increasing business in the South. The new office is located in Baltimore in the Guardian Trust Building, corner of Calvert and German streets. The Baltimore office will enable the company to keep in closer touch with the large amount of Government work constantly being done and also to handle more conveniently the increasing demand for its various products throughout the South. The manager of the new office is Mr. W. H. A. Davidson, who goes there from the New York office, where he has been for many years. He has sold Lundell motors ever since they have been on the market, and is thoroughly familiar with their characteristics.

THE MORRIS ELECTRIC COMPANY, of New York City, has just made shipment of what is claimed to be the largest number of iron poles ever shipped from this country in one lot. The contract called for no less than 8,000 poles intended to be utilized for the transmission line of the water power plant, which is being erected by the General Electric Company, at an estimated cost of three-quarters of a million dollars, for the purpose of operating the far-famed Mysore Gold Fields in India. The power house is to be installed at Cauvery Falls, ninety-three miles distant from the gold fields. The poles, which were manufactured by the Electric Railway Supply & Equipment Company, of Cincinnati, aggregated a weight of nearly 1500 tons. The contract was valued at $16,500.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, of Cincinnati, Ohio, has secured a contract for the installation of its special system of newspaper motor control in the printing plant of *El Diario*, one of the most prominent newspapers published in Buenos Ayres, Argentine Republic. The contract, which is valued at $12,500, calls for twenty motors, varying from 1-hp to 40-hp each. Current to run these machines will be derived from the central generating station of the Buenos Ayres Tramway Company. The Cincinnati concern has also been awarded a contract for the equipment of a generating plant in Tasmania. The value of the order is said to exceed $11,000.

PLANS FOR BELLOWS FALLS, VT.—The Fall Mountain Electric Light & Power Company has succeeded to the Bellows Falls Electric Light Company and makes the following announcement: "The aim of this company will be to establish a modern plant for the generation and supply of electricity, as speedily as possible, and with that end in view, we are perfecting plans for the building of a steam auxiliary plant, where a complete duplicate generating plant will be held as a reserve in case of interruption to the service of the main plant; the latest modern apparatus will be installed and in general everything will be done to make the service modern in all respects."

THE ELECTRIC STORAGE BATTERY COMPANY has recently closed a contract with the Camden & Suburban Railway, N. J., for the installation of an additional battery of chloride accumulators, making the third order received from this company. The new battery sub-station is necessitated by the extension of the railway company's lines to Moorestown, a distance of ten miles from their power house at Camden, and will be located at Pensauken Creek, near Moorestown. The battery will consist of two hundred and forty cells, having a capacity of two hundred kilo-watt hours.

THE AMERICAN BRIDGE COMPANY has grouped all its Eastern plants in one section, and has appointed Mr. A. J. Major, formerly manager of the Bridge and Construction Department of the A. & P. Roberts Company, as manager of all of these plants, which include the following: The Pencoyd plant, the East Berlin plant, the Buffalo plant, the Edge Moor plant, the Elmira plant, the Groton plant, the Hilton plant, the Horseheads plant, the Trenton plant, the Post & McCord plant, the Rochester plant and the Union plant.

THE AMERICAN STOKER COMPANY, of New York City, is reported to have recently closed contracts for the shipment of over sixty underfed mechanical stokers for various parts of the world. The Halifax Electric Tramways Company, of Halifax, Nova Scotia, is to be equipped with eight machines. Six stokers are to be shipped to the Brisbane Tramways Company, of Brisbane, Queensland, while other Australian contracts include four equipments, which will be installed in the principal generating station of the Sydney Tramways Company.

TROLLEY WORK IN NEW ENGLAND.—A considerable amount of electric railway is in process of construction up in New England, under General Electric engineers: The Boston & Worcester, with J. Shaw in charge; Rockingham County (Portsmouth, Dexter, etc.), W. D. Lovell; Nashua, Lawrence & Haverhill, C. E. Barnes. Then there is the work on the Boston Elevated, with Mr. A. Anthon in charge, with headquarters at 10 Milk street, Boston.

CLAY CONDUITS.—The clay working and coal mining interests of John T. McRoy, maker of the well known "McRoy conduits," situated at Brazil, Ind., which he has conducted for the past five years, have been incorporated as the McRoy Clay Works. "McRoy conduits" will continue to be the principal product manufactured. Hereafter, the headquarters of the company will be Brazil, Ind., with branch offices in Chicago and New York.

PRINTING TELEGRAPH.—A series of tests of the Murray page-printing telegraph system recently made between Boston and New York, extending over a fortnight, were remarkably successful, a column of the New York *Herald* being repeatedly transmitted without any error at speeds varying from 60 to 96 words a minute. A number of ordinary commercial messages were also transmitted with equally satisfactory results.

THE KEHIN ELECTRIC RAILWAY COMPANY, Japan, has placed an order with the Westinghouse Electric & Manufacturing Company, through Takata & Co., for the supply of one 150-kw generator, a number of small motors, switchboard, instruments and other accessories required for an extension of its power plant.

Ahearn & Soper, of Ottawa, Canada, who have long been actively connected with Canadian electrical development and the representation of American electrical manufactures in the Dominion, announce that their busineses has now been incorporated as Ahearn & Soper, Limited.

CATALOGUES AND PRICE LISTS WANTED.—La Compania Electrica de Regla & Guanabacoa, of which H. H. Rivera de Gray, Regla, Cuba, is electrical engineer, desires to receive catalogues and price lists of electrical machinery and supplies, engines, etc.

General News.

THE TELEPHONE.

PERU, IND.—Jerome B. Herff has secured a telephone franchise at this place.

TEMPLE, GA.—J. B. Earle and J. E. Boynton have obtained a telephone franchise here.

WEST UNITY, OHIO.—The Citizens' Telephone Company has been organized to install a local exchange. Capital stock, $15,000.

ALLIANCE, OHIO.—The Columbiana County Telephone Company is building a line connecting the exchanges at Salem, Sebring and Alliance.

CLEVELAND, OHIO.—The Cuyahoga Telephone Company has opened its two branch exchanges, one in Newburgh and the other in East Cleveland.

SHERIDAN, IND.—The Central Indiana Telephone Company has made plans to build a toll line to Arcadia and establish an exchange at that place at once.

SALEM, OHIO.—The Columbiana County Telephone Company has completed details for the establishing of 27 toll stations with automatic toll boxes in this county.

BRAZIL, IND.—Rural telephone service is rapidly increasing in Clay County. The plan in vogue for making extensions is for each farmer-subscriber to build one mile of line.

ALBANY, N. Y.—The Cuba Telephone Company of Cuba has been incorporated. Capital, $12,000. Directors: Charles Richer, Clarence Richer and G. H. Richer, Cuba.

MACON, GA.—The St. Petersburg Telephone Company has been incorporated by T. C. Parker, John W. Markham, Charles L. Goodrum and William B. Birch. Capital stock, $10,000.

GUTHRIE, OKLA.—The Osage Telephone Company was granted a charter Jan. 12. Its capital stock is $10,000. The incorporators are Elijah N. Yates, W. Brideville and Elliott B. Gravet.

BELLEVUE, OHIO.—The Bellevue Telephone Company is enjoying a healthy natural growth. It now has 340 subscribers, 40 of which were obtained last year. It has a switchboard capacity of 400 drops.

GALLATIN, MO.—Articles of incorporation have been granted the Davies County Telephone Company. The capital stock is $5000. The incorporators are C. J. Bain, J. W. P. Lane, M. L. Bain and others.

XENIA, OHIO.—C. D. Juvenall of Upper Sandusky, A. A. Dye of New Philadelphia, Elias Haiman, J. M. Blatt and I. N. Dufan of Cleveland are organizing a local independent company and have applied for a franchise.

COLDWATER, OHIO.—The Co-operative Telephone Company of this place now has 38 subscribers and a switchboard capacity of 250 drops. The company reports a steady growth in the number of subscribers. Mr. Anthony Rathweg is secretary.

METROPOLIS, ILL.—The franchise granted to the Cumberland Telephone & Telegraph Company recently was repealed by the City Council Jan. 14. The company's attorney stated that suit for damages will be instituted at once against the city.

RAVENNA, OHIO.—The Ravenna Home Telephone Company has elected the following directors: E. M. Waller, E. R. Taylor, W. W. Stevens, J. F. Babcock, C. F. Pitkin, H. L. Beatty. The capital stock has been increased from $10,000 to $20,000.

AKRON, OHIO.—The People's Telephone Company has just completed traffic arrangements with the United States Telephone Company for New York and Chicago service. The United States Company is putting up a line from Akron and Cuyahoga Falls to Medina.

CARROLLTON, OHIO.—The Stark County Telephone Company has applied for a franchise for an exchange in this place, and has been assured that it will be granted. A toll line will be built from Carrollton to Steubenville, via Harlem, New Amsterdam and Richmond.

EAST LIVERPOOL, OHIO.—The Columbiana County Telephone Company has settled the differences with striking linemen and the men have returned to work at $2.50 per day for such days only as outdoor work can be done. The company offered $55 per month for winter months.

LEWISBURG, PA.—The Home Telephone Company of this place now has 340 subscribers, of which 140 were acquired during the last year. Proposed extensions include 50 new subscribers and a Williamsport trunk line connection. Mr. John P. Ruhl is the manager of the company.

CINCINNATI, OHIO.—The Cincinnati Telephone Company shows a gain of over 2000 subscribers during the fiscal year just ended. This company, the City & Suburban Telegraph Association, as it is called, has successfully combatted all efforts of outsiders to secure a competitive franchise.

BRITT, IA.—The Western Telephone Company has purchased the entire stock of the Iowa & Nebraska Telephone Company, valued at $100,000. This includes the exchanges at Sheldon, Sibley, Estherville, Spirit Lake and Cherokee. The Western Company operates 2700 miles of line in Iowa, Minnesota and the Dakotas.

NASHVILLE, ILL.—An extension of the long-distance line of the Union Telephone Company, between this city and Okawville, will soon be commenced. During the year the Union Company acquired several minor lines in this part of the State and now has an excellent system. A line between this city and Irvington will also be erected.

CLEVELAND, OHIO.—The talk of consolidation of the Cleveland Telephone Company (Bell) and the Cuyahoga Telephone Company has again been revived. The Cleveland Telephone Company's offices have recently experienced a thorough shaking up. A large number of employees in the construction and contracting departments have been discharged.

TOLEDO, OHIO.—The long-talked-of Toledo independent company has materialized by the organization, a few days ago, of the Toledo Telephone, Telegraph & Messenger Company, with a capital stock of $25,000. The incorporators are J. H. Bellows, L. P. Harris, C. F. Watts, H. A. Merrill and A. M. Hough. It is proposed to conduct a telephone, telegraph and messenger service in Toledo and in Lucas, Williams, Fulton, Ottawa, Erie, Ashland, Sandusky, Lorain and Cuyahoga counties. The company is backed by Toledo capital and a franchise will be applied for at once.

CLEVELAND, OHIO.—The Federal Telephone Company, which is the controlling organization of the United States Telephone Company and other allied independent companies, has completed arrangements whereby it takes over the organization of the Interstate Telephone Company, the Galion Telephone Company and the People's Telephone Company of Shelby. It is now making preparations, getting out bills of material, etc., for the coming year's work, which indicates that the year 1901 will be equally as active with this company as any previous year.

THE NEW ENGLAND TELEPHONE & TELEGRAPH COMPANY issues a special notice to its subscribers that, owing to the rapid increase in the number of subscribers in the present Haymarket Exchange district, Boston, it becomes necessary to divide the district, making two exchanges in place of one. On April 1, a new exchange will be opened under the name of "Richmond." In consequence of the establishment of numerous exchanges within the city, the designation "Boston," which has heretofore been employed for the Milk Street Exchange, has ceased to be distinctive, and on Jan. 1 the use of this name was discontinued and the name "Main" substituted.

ELECTRIC LIGHT AND POWER.

MT. STERLING, KY.—The electric light plant here is to be enlarged.

NEWCASTLE, DEL.—A municipal electric light plant may be erected here.

GAINESVILLE, GA.—A company proposes to build an electric light plant here.

PORTSMOUTH, N. H.—The Portsmouth Gas, Electric Light & Power Company will, it is reported, erect a new plant.

BUFFALO, N. Y.—The Buffalo & Niagara Falls Electric Light & Power Company has increased its capital stock from $200,000 to $500,000.

ROCKINGHAM, N. C.—This city will petition the Legislature for permission to issue bonds for erecting an electric light plant and water works.

DARTMOUTH, N. S.—The Council for the town will apply to the local Legislature for authority to borrow $40,000 for electric lighting purposes.

ANNAPOLIS, N. S.—The rate payers of the town of Annapolis have decided to take over the O'Dell electric light plant of the town and operate it under municipal ownership and control.

TAMPA, FLA.—The city has voted affirmatively on the question of issuing the $250,000 of bonds for acquiring the city waterworks and an electric-light plant if there is enough money left.

TRENTON, N. J.—The Freehold Electric Light, Heat & Power Company, with a capital of $10,000, has been incorporated by Rulief P. Smock, Freehold, N. J.; Joseph McDermott, Freehold, N. J.

ELLICOTT CITY, MD.—Jacob Shaw, of Ellicott City; George L. Mone and Edw. L. Ward, of Baltimore, have bought the light plant of the Ellicott City Electric Company, and will operate it.

COLUMBUS, OHIO.—W. H. Sharp and John J. Chester, who are building a number of apartment houses and dwellings on the North Side, have applied for a franchise to install and operate an independent lighting system.

RAVENNA, OHIO.—The Ravenna Gas & Electric Light Company has elected officers as follows: Charles Merts, president; W. H. Hayes, vice-president; W. H. Beebe, treasurer; E. P. Merts, secretary; E. C. Lindsey, superintendent.

WINSTON-SALEM, N. C.—The North Carolina Electrical Power Company will increase its capital stock of $100,000 and arrange for an immediate continuance of the work for developing its water power and transmitting electrical energy for factories, etc.

GREENVILLE, ILL.—Local capitalists are considering the proposition of erecting and maintaining an electric light plant. The company operating the present city plant has raised its prices, and a meeting of the patrons will be held to consider the new plant proposition.

KENDALLVILLE, IND.—The City Council of this city has taken steps toward securing an incandescent electric-light plant. It is the purpose of making the new municipal plant auxiliary to the arc light plant, which has been operated very sucessfully by the city for several years.

OTTAWA, ONT.—Messrs. Robertson & Robertson, of Victoria, B. C., will apply to the Dominion Parliament for the incorporation of a company for the transmission of electric power and the construction and operation of telephone lines within the districts of Esquimalt, Victoria City and North and South Victoria.

SAN FRANCISCO, CALIF.—The Truckee River General Electric Company, which operates the transmission system, supplying the mines on the Comstock lode with electric power, recently declared its first dividend of 10 cents a share, payable Jan. 20. It is expected that a similar dividend will be paid each month in future.

RICHMOND, IND.—The citizens of this city are much aroused over the proposition of the City Council to expend over $144,000 for a municipal electric light plant. All of the bids recently opened exceed that figure, and a decided sentiment against awarding the contract has developed. It is probable that a suit will be brought to enjoin the Council from making the appropriation.

MINNEAPOLIS, MINN.—Mr. P. F. Crafts, representing the Eastern capitalists who are said to have purchased the plant of the International Electric Company recently, has been appointed receiver for the concern. This action was precipitated by a suit of the Minneapolis Loan & Trust Co., as trustee of the bondholders, to foreclose the trust deed to secure the outstanding bonds, amounting to $140,000.

ST. LOUIS, MO.—At the annual election of the Missouri Edison Electric Company last week the following officers were elected: S. M. Dodd, president; James Campbell, vice-president; Sherman B. Pike, secretary; C. L. Horton, assistant secretary; Jas. J. Kelly, treasurer. Directors: S. M. Dodd, James Campbell, J. C. Van Blarcom, Thomas H. West, James W. Bell, R. C. Kerens and Edwards Whitaker.

MINNEAPOLIS, MINN.—Mr. Thos. Lowry states that he, with other capitalists, will build a dam and electric power house at Coon Creek Rapids on the Mississippi River. Flowage rights have been obtained and surveys and plans are being made. The dam will be erected about nine miles from Minneapolis. The plant will supply the electric needs of Anoka and Columbia Heights. It is estimated that 10,000 horse-power are available at the falls.

CINCINNATI, OHIO.—It is now practically certain that the North American Company has secured control of the Covington Gas Company, the Covington Electric Light Company and the Newport Gas Company. The North American Company is also the owner of the Cincinnati Edison Electric Company, and those on the inside believe that the latest move is one calculated to assist the Cincinnati Edison Company in securing control of the Cincinnati Gas Company, a bitter competitor.

OTTAWA, ONT.—The movement in favor of municipal ownership and operation of electric light plants is gaining in popularity throughout the Province of Ontario. The town of Blenheim has just carried a by-law for the town to take over its electric light system; Parry Sound has also carried a by-law for $29,500 to purchase the electric light plant of the town and improve water works, and the electors of the town of Lindsay have voted in favor of municipal ownership of the electric light plant.

NEW YORK, N. Y.—Contracts have been awarded for the lighting of buildings and streets in the Boroughs of Brooklyn and Queens, as follows: Arc lights in Brooklyn to the Edison Company, of Brooklyn, at 34 cents per lamp per night for 1200-cp lamps and 17 cents per night for 600-cp lamps, providing 4000 or more are used. If less than 4000 are used the rate is to be 35 cents per 1200-cp and 18 cents per 600 cp. The contract for Queens electric lighting goes to the New York & Queens Electric Power Company for incandescent lamps at $25 per year each.

SANDUSKY, OHIO.—Bids have been opened by the city for electric lighting. The Sandusky Gas & Electric Light Company, which now has the contract, made a bid of $82.50 per lamp for five-year contract, and $80 for ten-year contract; its present rate is $87.50 for 166 arc lamps. The Citizens' Electric Light & Power Company offered a bid of $71 per lamp for five-year contract and $70 per lamp for ten-year contract. The Citizens' Electric Light & Power Company is an adjunct of the Sandusky & Interurban Electric Railway Company, and it has no franchise.

NEW YORK CITY.—The Park Commissioners have denied the application of a number of wealthy residents of Morningside Heights for permission to build an electric elevator in Morningside Park, between 116th and 117th Streets, the board considering that the proposed structure would mar the beauty of the scenery in that part of the park. Some time ago residents of Morningside Heights formed a company to construct an elevator, subject to the approval of the Park Commission. The heights at the point mentioned are very steep, and the summit can only be reached by a stiff climb up winding stone stairs and inclined pathways. Nobody has explained why the elevator shaft could not be run up through the face of the cliff, out of sight, instead of in the open.

NIAGARA FALLS, N. Y.—For several months the Common Council of the City of Niagara Falls held up the amount of the lighting bills of the Buffalo & Niagara Falls Electric Light & Power Company, the object being to force the company to work its employees in shifts of eight hours. At a recent meeting of the Council the city attorney called the attention of the mayor and aldermen to a decision of the Court of Appeals covering a similar case, and pointed out that the course adopted by the Council would not be sustained by the courts, but, on the contrary, that if the bills were not paid, costly suits for the city might result. The bills were immediately ordered paid. By the decision referred to it was shown that the city had no right or pretext to arbitrarily hold up the bills of the company for moneys due under the terms of a contract, for the purpose of enforcing the company to observe the eight-hour law.

THE ELECTRIC RAILWAY.

HAMILTON, OHIO.—Local capitalists are forming a new company for an electric railway from Hamilton to Eaton.

UNION, S. C.—A franchise has been granted to Col. T. C. Duncan and associates to build an electric railway in this city.

LEICESTER, ENG., has reported in favor of a trolley system of electric roads, and proposes to put in eighteen miles of double track.

NEW ALBANY, IND.—Louis Schneek and others have obtained a franchise for an electric railway between this city and Jeffersonville.

CANTON, OHIO.—James M. Ferguson, of Steubenville, is the promoter of an electric railway which will extend from Canton to Steubenville.

SHELBY, OHIO.—A. J. Kern and associates have been granted a 25-year franchise through this place for the proposed road from Bucyrus to Ashland.

ITALY.—An electric railway is proposed to run from San Niccolo to Agozzano, Italy. It is stated that London capitalists are interested in the scheme.

CHILLICOTHE, OHIO.—The Ross County Commissioners have withdrawn the franchise granted on Dec. 17 to the Columbus & Southern Electric Railway.

LIMA, OHIO.—The promoters of the Lima & Findlay Electric Railway have decided to change the route originally planned so that the road will pass through Blanchard and Benton Ridge.

LANSING, MICH.—Articles of incorporation of the Detroit & Charlevoix Railway Company have been filed. The company is capitalized at $525,000 and is wholly owned by the estate of David Ward.

CINCINNATI, OHIO.—The Cincinnati Street Railway Company is now building its own cars. Practically all departments are now in running order and every style of car is built entirely at this plant.

EAST LIVERPOOL, OHIO.—The stockholders of the East Liverpool & Wellsville Street Railway Company have decided to make a number of improvements to the road and to purchase a number of cars.

THE JERSEY CENTRAL will establish an electric automatic block signal system on its entire line between Bound Brook and White Haven. Many grade crossings will be eliminated in Bayonne and Newark.

READING, PA.—The differences between the employees and the United Traction Company of this city, noted last week, were finally adjusted by a board of arbitrators, nearly every demand of the strikers being granted.

AKRON, OHIO.—Thomas L. Childs, who has secured franchises in Stark and Summit counties for the Canton & Akron Electric Railway, has announced that he will build a new line from Akron to Cleveland, and franchises will be applied for.

SACRAMENTO, CALIF.—The Auburn Electric Railway Company was recently incorporated, with Auburn, Calif., as the place of business. Directors: A. S. Moore, B. F. Hartley, J. H. Wills, P. C. Moore and F. G. Flanagan. Capital stock, $50,000.

TAMPA, FLA.—A company has been incorporated here under the name of the Florida Sub-Peninsular Transportation Company, with a capital of $1,000,000. This company proposes to construct electric railways to a number of towns situated along the gulf coast.

INDIANAPOLIS, IND.—The Connersville Traction Company, capital $25,000, board of directors headed by J. C. McFarlan, and the Greensburg & Versailles Electric Railway Company, capital $100,000, board of directors headed by G. S. Littel, have been incorporated.

CINCINNATI, OHIO.—It is reported that formalities have been practically concluded whereby the Whitney-Elkins-Widener syndicate will secure control of the Cincinnati Street Railway Company. Mr. John Kilgour, president of the company, denies the truth of the report.

ASHLAND, OHIO.—At the meeting of the stockholders of the Norwalk, Ashland & Southern Railway Company Judge C. P. Wickham was elected president and C. F. Jackson treasurer. The road will extend from Norwalk to Ashland over a private right of way 36 miles in length.

BUFFALO, N. Y.—An effort is being made to organize a new company, capitalized at $800,000, out of the Buffalo, Hamburg & Aurora Railway Company. Those interested include George H. Blanchard, William Miller, Edward Henry and Luther Cary, all of Erie County.

BUCYRUS, OHIO.—The Buckeye Traction Company, of this city, has been incorporated by H. V. Flickinger, R. V. Sears, W. A. Blicke, S. J. Kibler, A. J. Scott and C. Feiring. It is the intention to build an electric railway from Bucyrus to Norwalk. The temporary capital stock is $10,000.

CINCINNATI, OHIO.—Application has been made for a franchise to build a new traction line from the present terminus of the Norwood (Cincinnati) Railway lines through the towns of Montgomery, Silvertown, Pleasant Ridge, Kennedy, Lebanon, Kings Mills, Warren and into Dayton, Ohio.

OTTAWA, ONT.—Information has been received that the Alaska Exploration Company, a syndicate capitalized in Great Britain, has laid plans before the Council for the Yukon District for the building of a $1,900,000 line of street railways through the main streets of Dawson City and out to the creeks.

SPRINGFIELD, OHIO.—A new company, soon to be organized, has made application to the Clarke County Commissioners for a franchise for an electric railway to extend from Springfield to South Charleston. The promotors are L. H. Houston, Edward Houston, J. F. Rankin and S. B. Rankin, of South Charleston.

DEFIANCE, OHIO.—The Northern Ohio Electric Railway Company has been incorporated by W. D. Sherwood, Elias Bartholomew, Charles H. Adkins, Gilbert Bartholomew, E. W. Fink, J. U. Merwin and C. H. Hubbard for the purpose of constructing an electric railway from Defiance to Bryan. The capital stock is $25,000.

ANDERSON, IND.—A train-dispatching system is being inaugurated by the Union Traction Company between this city and Indianapolis by means of the telephone. There are switches every two and a half miles. The conductors carry receivers that can be attached to wires suspended every half mile from the wires overhead.

SANDUSKY, OHIO.—The Sandusky & Interurban Electric Railway has submitted a bid for municipal electric lighting under the name of the Citizens' Light & Power Company. In case it secures the contract it will be necessary to string new wires over the whole city, as the Sandusky Electric Company has always enjoyed a monopoly of the business.

CHATTANOOGA, TENN.—Application has been made here for a charter for the Chattanooga & Lookout Mountain Railroad Company by the recent purchasers of the Chattanooga Rapid Transit Company, Clarence P. King and others of Philadelphia, to enable the company to do a general freight business in connection with passenger service.

OTTAWA, ONT.—Letters of incorporation and a charter have been granted by the Ontario Government to the Queenston, Niagara & Port Dalhousie Electric Railway. The share capital of the road is $40,000, and it proposes to connect Queenston with Niagara-on-the-Lake, the latter place with Port Dalhousie, and the latter town with the city of St. Catherines.

CLEVELAND, OHIO.—The gross earnings of the Cleveland Electric Railway Company for 1900 were $2,061,434. In 1898 the gross earnings were $1,739,331, and in 1899, through the influence of the strike, they dropped to $1,509,003. The operating expenses and taxes for the year were $1,119,986, as compared with $1,046,592 for 1898 and $967,949 for 1899.

COLUMBUS, OHIO.—The new blanket franchise, granted the Columbus Street Railway Company, provides for the double trolley system as a safeguard against electrolysis. The company is to pay the city $10,000 a year and 2 per cents of its gross receipts in excess of $1,000,000, with an extra 1 per cent for

each additional $250,000. These cash payments are to cease whenever the company sells eight tickets for 25 cents. The franchise is for 25 years.

BRAZIL, IND.—The Stone & Webster syndicate has arranged to locate a $200,000 rolling mill at this place. The company announces that it will build one or more electric railroads out of Brazil into the populous districts touching Carbon, Diamond, Cardinia, Benwood Perth, and Bridgeton. This company owns the Brazil street car system and electric light plant, also the Terre Haute street railway system and electric light works, besides the interurban line between these two cities.

NEWARK, N. J.—The report is confirmed that the Raritan Traction Company has secured from the Freeholders of Middlesex County, N. J., the right to extend its lines to New Brunswick and to Woodbridge, thereby giving it connections with the Consolidated Traction Company of New Jersey and enabling the company to run from Perth Amboy to Jersey City by trolley. The Raritan Traction Company is a consolidation of the Perth Amboy Railroad and the Raritan Trolley Company, and is owned by New York capitalists.

CINCINNATI, OHIO.—The Westinghouse Electric Company has a contract to furnish the electrical equipment for the Columbus & Buckeye Electric Traction Company, the cost being in the neighborhood of $160,000. The main power house will be at Hebron, midway between Columbus and Newark. Sub-stations will be located between Hebron and Columbus and between Hebron and Newark. Alternating current at 1500 volts will be transmitted to the rotary substations and there transformed to 550 volts direct, which will be used to operate the cars.

THE TOLEDO, FOSTORIA & FINDLAY ELECTRIC RAILWAY COMPANY, and the Dover Construction Company, which is building the road, have closed contracts for the equipment of the power house now building near Fostoria, Ohio. The Westinghouse Electric & Manufacturing Company will furnish two 250-kw engine type railway generators, 640- volt, 150 r. p. m.; one 75-kw 200-volt motor-driven booster, and an eight-panel switchboard. The Arbuckle-Ryan Company, Toledo, will furnish a 400-hp Russell engine. Contracts have also been closed for six Jewett Car Company's cars, to be equipped with 55-hp Westinghouse motors and Peckham trucks.

THE AUTOMOBILE.

AUTOMOBILE CLUB OF AMERICA has before it as candidates for active members, A. C. Harmsworth, of the *London Daily Mail;* H. Ward Leonard, the electrical engineer, and W. K. Vanderbilt.

COLLECTING MAIL BY AUTOMOBILE.—The Post Office authorities in Boston have made arrangements to use three steam automobiles for the purpose of collecting mails in the Back Bay district.

NEW YORK CYCLE SHOW last week was quite a success, but only a few automobiles were shown, chiefly by the American Bicycle Company, including six Waverley electrics. The Boston Motor Carriage Company showed a new electric runabout with a single motor. Chas. E. Miller had a good exhibit of automobile supplies.

LOUISVILLE, KY.—The first and only electric delivery wagon in the State of Kentucky was sold to the John C. Lewis Company (large department store) by G. W. Hubley, agent for the American Electric Vehicle Company of New York. The vehicle has proven most successful in this class of work and has been in daily working service without interruption during the past three months and averages 35 to 40 miles per day.

THE BOSTON AUTOMOBILE SHOW.—The automobile show to be held in Mechanics' Building, Boston, during the week of March 4 to 9, inclusive, will, according to indications, be a success. It is proposed to have daily exhibitions of automobiles in operation, under the supervision of a committee selected from the local automobile clubs. Manufacturers in every section of the country, it is stated, are taking an interest in the exhibition.

NEW INDUSTRIAL COMPANIES.

NEWARK, N. J.—The Newark Electro-Galvanizing & Plating Company has been incorporated; capital, $25,000. Incorporators: Edward Lyman, New York; Charles L. Kingsley, attorney, New York.

ALBANY, N. Y.—The United States Electric Contracting Company, of Syracuse, has been incorporated; capital, $40,000. Directors: David Cronin, F. S. Rogers and E. R. Caldwell, Syracuse.

THE MISSOURI ELECTRICAL COMPANY, with a capital stock of $20,000 all paid up, has been incorporated at St. Louis, Mo. Robert W. Moore, Fred B. Little, Wm. F. Little, W. F. Little and stockholders.

ST. LOUIS, MO.—Articles of incorporation have been filed by the Imperial Electric Plating & Manufacturing Company. The capital stock is $5,000. John S. McKinley, Frank R. Harris and Frank L. Horton are the incorporators.

LEGAL.

COMPLAINT DISMISSED.—Justice W. M. Smith, of the Supreme Court in Brooklyn, dismissed the complaint of Mark Farrell against Noah L. Cocheu. Mr. Farrell is a stockholder in the State Electric Light & Power Company, and brought suit against Mr. Cocheu, charging him with conspiracy and violation of his office as president, director and general manager of the State Company in selling the plant to the Amsterdam Electric Light, Heat & Power Company. In dismissing the complaint Justice Smith says that the company was heavily in debt and the only asset it had was its franchise, and that in order to save this a mile of conduit had to be laid. The company did not possess enough money to lay the conduit, and therefore Mr. Cocheu, after giving notice to the stockholders, sold the franchise to the Amsterdam Company. The proceedings were regular, Justice Smith states, and Mr. Cocheu's action was ratified by the stockholders.

OBITUARY.

THE LATE F. A. GILBERT.

MR. F. A. GILBERT, president of the Boston Electric Light Company, died quite suddenly while in New York City last week. He was dining at the New York Club with Mr. J. P. McQuaide and was seized with a choking, apoplectic fit. He appears to have died almost instantly, the doctors being able to afford him no relief. He was only fifty-four years of age and was a man of very corpulent habit of body, so that he suffered from shortness of breath. He was one of the pioneers in the development of electric lighting in New England, and at the time of his death was an officer or stockholder in such companies as the Boston, New Haven, Newport, Bridgeport, Portland, etc. He became interested in the Boston field in 1888 through the foreclosure purchase of the Merchants' Electric Light Company; and soon after he consolidated all the interests, except the Edison, in the Boston Electric Light Company. As these columns have recorded, a deal with the Boston Edison Company was on foot, and it is understood that he was in New York in connection with the difficulties that had arisen in the matter. His estate is estimated at from $500,000 to $1,000,000; he held 1000 shares of Boston Electric Light selling at over 200. He was a director in the New England Electric Vehicle Company and the Copper Range Railroad, and was heavily interested in copper mining. For some years he had been president of the Massachusetts Electric Light Association, but had steadfastly declined the frequent requests to serve as president of the National Electric Light Association. Aside from his great executive ability, he was of genial disposition, enjoying society and taking a keen interest in life's affairs generally. The funeral services took place at New Haven on Jan. 21.

EDWIN HOLMES.—Edwin Holmes, president of the Holmes Electric Protective Company, died on Thursday, Jan. 17, in New York City, from a complication of diseases. He was born in West Boylston, Mass., eighty-one years ago, and was educated at the Leicester Academy. At the age of twenty he was engaged in Boston in what was then known as the "Yankee notions" business. He began the study of electricity in 1857 and two years later got a patent for an electrical appliance called the "Home Protector." This apparatus was a system of stringing wires connected with a bell which would announce the opening of a door or window in the house once the alarm had been set. He then came to this city and became interested in the development of the telephone. He was president of the first telephone company in this city, which afterward became the Metropolitan Telephone Company, and which is now part of the Bell system. In 1873 he conceived the idea of furnishing protection to the banking houses, and the jewelry houses in the Maiden Lane district, with his burglar alarm system and he located a station in Pine street. The Holmes Electric Protective Company was formed in 1883. Mr. Holmes married Elizabeth A. Richardson of his native town. She and three children survive him. The children are Edwin T. Holmes, who was associated with his father in business; Mrs. J. Stewart White and Mrs. A. S. March, of Orange, N. J.

PERSONAL.

DR. A. E. KENNELLY is to lecture before the Franklin Institute and the Y. M. C. A., Philadelphia, on Feb. 1, on solar eclipses and what they teach us.

PROF. E. P. ROBERTS, of Cleveland, Ohio, at the January meeting of the Cleveland Electric Club, read a paper on "The Design of Electric Railway Power Stations."

MR. J. J. OOLGARDT, who had charge of the General Electric exhibit at the Paris Exposition, has closed up all his work there, and has just returned home. He went up to Schenectady last week.

MR. OZRO N. WISWELL, formerly of Lynn, Mass, and for the past eighteen months the city electrician of the Municipal Electric Light plant of the city of Tacoma, has severed his connection with the city.

MR. C. W. RICE, on the evening of Jan. 18, gave a lecture before the Electrical Section of the American Institute of the City of New York, on the subject, "High Potential Distribution About New York City."

MR. W. J. CLARK, European manager for the General Electric Company, arrived in this city last week from London, but was confined to his hotel by illness, much to the regret of a host of friends anxious to see him.

MR. JAMES R. CHAPMAN, electrical engineer for the Union Traction Company, Chicago, has been employed by Charles T. Yerkes to superintend the construction and equipment of his underground railway system in London.

GEN. A. W. GREELY, chief signal officer, has disclaimed an intention on the part of the Government to use the Pupin method on its lines. He thinks it might be tried between Key West and Cuba by some company, but not on any Pacific cable.

MR. J. W. RENO, the engineer, who has lately been engaged in the development of electric stairways and whose system is in quite general use, was married on Jan. 15 in New York City, to Miss Marie H. Snowman, daughter of Mr. W. Hagenah.

LORD KELVIN, Master of the Clothworkers' Company, has accepted an invitation to dine with the governors of the Yorkshire College on Feb. 1, on the occasion of their annual gathering at Leeds. He is expected to deliver an address on textile industries.

GENERAL MANAGER McLEAN, of the Toledo Traction Company, will, it is reported, shortly resign to accept the position of general manager of the South Side lines in Chicago. Mr. McLean is at present recuperating his health in the West Indies. He will return to Toledo about Jan. 30.

MR. T. M. MESTON, the energetic secretary of the Emerson Electric Manufacturing Company, of St. Louis, Mo., is a visitor in the East and was at the company's New York headquarters last week. He reports very hopefully on the present situation, and is about to introduce some admirable novelties in the general line of power work.

MR. ROBT. T. LOZIER, of the Bullock Electric Company, of New York City, which concern acts as Eastern sales representative of the Bullock Electric Manufacturing Company, of Cincinnati, has been appointed a general sales agent of the Ohio concern. Mr. Frank G. Bolles, the advertising manager, has returned to headquarters at the factory.

MR. MARTIN O'BRIEN, late of the American Telephone & Telegraph Company's Chicago office, has removed to Providence, R. I., where he enters the employ of the Clark Automatic Telephone Switchboard Company. He has had an extensive experience in the telephone business, and will considerably augment the effective force of the latter company in its interesting new field of work.

MR. E. H. WISE, foreman of the Cambria Steel Company's electrical department at Johnstown, Pa., and John W. Carter, the company's superintendent of supplies, have jointly patented a design for a steel hopper-bottom freight car. The design is especially adapted for coke haulage. A crank manipulates the mechanism for emptying the car. It is believed that the Cambria Company may build the car as a new branch of business.

MR. PAUL H. BRANGS, for the past eleven years electrical engineer for the Lackawanna Railroad and during the past year sales agent for the Safety Car Heating & Lighting Company, has accepted a position as general Eastern agent for the Heine Boiler Company. He will assume his new duties Feb. 1, and will have his headquarters at the Bowling Green Building. Dating back to the early Edison and Maxim days in electric lighting, Mr. Brangs had a large experience and wide acquaintance, and brings boundless energy to his new work.

MR. CHAS. J. GLIDDEN, who has just resigned the presidency of the Erie Telegraph & Telephone Company, and may soon, it is rumored, retire from the telephone business on his handsome fortune, has been connected with the Erie company nearly eighteen years, being one of the organizers of the company in 1883. He has held the position of secretary, treasurer, vice-president and president. He has been connected with the telephone business over twenty-four years, starting the canvass for subscribers at Lowell in 1877 and serving a number of years as treasurer of several companies making up the New England Telegraph & Telephone Company and later being secretary of that company, which position he resigned in 1884.

Trade Notes.

THE DAYTON ELECTRICAL MANUFACTURING COMPANY, Dayton, Ohio, has increased its capital stock from $20,000 to $50,000.

THE WESTERN ELECTRIC CO., Chicago, in Bulletin No. 7009, describes and illustrates its series enclosed alternating arc lighting system.

AIR HOISTS.—The Northern Engineering Works, Detroit, Mich., in a pamphlet describes and illustrates its air hoists and pneumatic lifting appliances.

NEW ELECTRICAL COMPANY.—Mr. David Cronin, of Syracuse, N. Y., dealer in electrical supplies, has been succeeded in his business by the United States Electrical Contracting Company of the same city.

THE OTITO ELECTRIC COMPANY is the name of a new concern at 464 State Street, Schenectady, N. Y. The company will conduct a business of wiring for electric light, bells, burglar alarms, etc., and will also install private telephones and repair the same.

THE CONSOLIDATED RAILWAY ELECTRIC LIGHTING & EQUIPMENT COMPANY, New York, has distributed a very convenient telephone call book, which no doubt will prove a great convenience in any office which may be fortunate enough to receive one.

WAGNER OFFICERS.—The following directors and officers were elected at the meeting of the Wagner Electric Company, St. Louis, Mo., on Jan. 14. Directors—S. M. Dodd, S. B. Pike, James Campbell, James W. Bell, J. C. Van Blarcom, Ferd Schwerdtmann and H. A. Wagner. Officers—S. M. Dodd, president; James Campbell, vice-president; S. B. Pike, secretary; W. A. Layman, treasurer.

THE PELTON ENGINEERING COMPANY, Cleveland, Ohio, announces the removal of its office and factory to the corner of Merwin and James Streets, that city, at which location the company will have every facility for better serving its patrons. The company conducts a business as contracting engineers, and installs steam apparatus, dynamos, motors, switchboards and machine tools, and carries full lines of supplies.

INTERIOR TELEPHONE.—The Simplex Interior Telephone Company, Cincinnati, Ohio, is making a line of high grade intercommunicating interior telephones for factories, warehouses, etc. The system is operated from a central battery. The transmitters are of granular carbon mounted in a hard-rubber cell, and the receivers are of the bipolar type. All parts of the instruments are made and finished in the best manner.

THE ANNESS-FREEMAN MANUFACTURING COMPANY, Hamilton, Ohio, has been incorporated, with $25,000 capital stock, to manufacture motors, generators and other electrical appliances under the patents owned by W. P. Freeman. The incorporators of the company are W. H. Anness, Louis F. Utz, W. D. Campbell, Aaron Wescoe and W. P. Freeman. A factory is being built in Hamilton which will be completed early next spring.

FRANKLIN'S BIRTHDAY.—The Franklin Electric Manufacturing Company, of Hartford, Conn., mailed to its friends on Jan. 17, Franklin's birthday, a steel engraved portrait in miniature of the good old scientist, diplomat and author, superscribed with a facsimile of his famous autograph. The attractive little gift was accompanied by a note calling attention to the fact that it commemorated the natal day of the company's grand old "godfather."

FIRE IN ST. LOUIS.—The factory of the Central Telephone & Electric Company, at 909 Market Street, St. Louis, Mo., was damaged by fire on the morning of Jan. 12. The loss falls somewhere between $6,000 and $10,000. The office and factory, together with goods of the St. Louis Electrical Supply Company, at 911 Market Street, were considerably damaged by water and smoke. The losses are covered by insurance. It is the opinion that the fire started spontaneously.

THE AMERICAN BRIDGE COMPANY will furnish the steel work for the new 10-story office building to be erected by the Mutual Savings Bank, San Francisco, Calif., and the Gillette-Herzog Manufacturing Company will supply the steel work for the office building to be erected by the Surety Investment Company at East Denver, Colo. The American Bridge Company announces that its New York contracting office will hereafter be in charge of Mr. S. Fischer Miller, formerly with Milliken Bros.

RUSSIAN STUDENTS.—Mr. Charles A. Olson, of the Crane Company, Chicago, formerly superintendent for the Westinghouse Company, at St. Petersburg, Russia, was a recent visitor at the International Correspondence Schools, Scranton, Pa. Mr. Olson stated that a number of men in his employ in Russia were students of the Schools. As instruction is carried on by mail, no difficulty is experienced in teaching students at a distance, and in fact the schools have students in over one hundred foreign countries.

THE ELECTRIC EQUIPMENT COMPANY.—Mr. Chas. J. Klein, formerly general superintendent of the New York Electric Equipment Company, has organized the Electric Equipment Company and become its president. The company's headquarters are at 101 West Thirty-ninth Street, New York, and it will conduct an electric equipment business, for which Mr. Klein is certainly eminently fitted, after an experience of eighteen years. Mr. Klein will give personal attention to all contracts entrusted to the new company.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has closed a contract with the Cleveland Twist Drill Company, Cleveland, Ohio, for equipment to increase the capacity of its power house, which was completed some months ago. The installation will consists of one 200-kw two-phase 240-volt alternating current generator, 7200 alternations, with exciter and switchboard. The Cleveland office of the Westinghouse Company reports that the use of alternating current apparatus for factory drive is rapidly growing in favor in its district.

A NEW MAGAZINE IDEA.—*Cassier's Magazine*, beginning with the new year, has put into practical shape a novel idea in magazine make-up—a "Library Edition," as it has been called. Instead of having the usual paper covers, this "Library" copy each month hereafter will be available in handsome cloth covers, with gilt lettering, printed on extra heavy paper—constituting in fact a copy *de luxe*. In this form, each separate copy of *Cassier's* will be a substantial volume, likely to have a much more enduring life than that of simply one single month.

SOME FORGE SHOP PLANTS have of late been provided with only a single fan blower designed to produce the blast for the fires and at the same time by means of a special piping arrangement to exhaust the resulting smoke from the hoods. In a recent paper read before the American Society of Mechanical Engineers Mr. William Sangster shows that "such an arrangement is not economical, since a much larger volume of air must be raised to a high pressure than if a separate fan had been used for the exhaust system. In the case given above we should have to handle five times 140 cubic ft. of air at 4 oz. pressure, requiring 1.25 hp., instead of .44 hp. for each forge. Even in a small system the power saved by the extra fan will pay for its cost in less than a year's time."

MINIATURE LAMPS.—The American Endoscopic Company, Providence, R. I., announces a new line of novelties. Among the latest productions of this company is the portable electric display sign which is designed for window display. It consists of a circular frame around the edge of which is a row of lamps. The space in the interior admits a card 20 ins. in diameter, upon which any advertisement may be placed. Eighteen and 20 lamps are placed on these signs. Another novelty is the electric hat pin for ladies, which is a perfect imitation of a miniature electric light. It is made in the following colors: Ruby, green and frosted. The Endoscopic Company makes a full line of electric novelties, such as night lamps, scarf pins, etc., its standard products being surgical lamps, dental lamps, series lamps, candelabra lamps, etc.

NEW ENGINEERING FIRM.—Messrs. George Weston and Charles V. Weston have formed a copartnership as consulting and contracting engineers under the firm name of Weston Brothers, with offices at 711 Merchants' Loan & Trust Building, Chicago, Ill. The firm will give attention to steam and electric railways, bridges, buildings, foundations, tunnels, plans, specifications and supervision of work. It has had long experience in the construction and development of railway properties, and it is especially fitted to carry on the business in the various lines above mentioned. The firm will make a special feature of the examination of street railway properties for the purpose of making full and trustworthy reports for the guidance of the investors.

THE ELECTRIC STORAGE BATTERY COMPANY has placed on the market a new type of chloride accumulator especially adapted to the requirements of telegraph, fire and police alarm, laboratory and other service where voltage rather than amperage is desired. This "BT" type, although of identical plate construction to the other sizes of accumulators manufactured by this company, is peculiar in having the positive and negative plates, together with the lugs or connectors cast in one section, forming "couplets," in this way obviating entirely the necessity for bolt connectors or burning, to set up the battery. The plates are simply lowered in the receiving jars and the only connections to be made are at the terminals, thus effecting a very considerable saving of labor in installation. The "BT" cell is made in one size only, the plates being 4" x 3 1-16", the discharge in amperes for eight hours being ¾ of an ampere, for five hours 1 ampere and for three hours 1¼ amperes. A circular describing these cells will be forwarded upon application to any of the company's offices.

THE STUART-HOWLAND COMPANY, of Boston, is making a name for itself and building up a large business. Its growth has been exceptionally rapid. It started in the electrical supply business April 2, 1900, in a modest way. It has had to move into larger quarters since then, and now has seven salesmen on the road. As an example of the kind of supply business it is doing, two orders which it has on its books at the present time for lighting supplies amount to over $20,000. On August 6 it added street railway supplies to its line, and has already furnished the overhead material for 12 new roads, having orders on its books

for 175 miles of street railway equipment. Mr. H. W. Smith, who has charge of the street railway department, is a good "live" man, with an extensive acquaintance, and is building up its business in this department in a substantial manner by making customers of some of the best roads in New England. The line which the Stuart-Howland Company carries is a very complete one, not only in street railway material, but also in lighting supplies, telephones, etc.

Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 15, 1901.

[Conducted by William A. Rosenbaum, Patent Attorney, Times Bldg., N. Y.]

665,864. COMPOSITION FOR CLEANING METALS; J. L. Bach, Buffalo, N. Y. App. filed Oct. 19, 1900. (See Current News and Notes.)

665,882. ELECTRIC ARC LAMP; J. A. Delzell, Lynn, Mass. App. filed Dec. 7, 1898. Details of a clutch carrier for the Brush-type of arc lamps.

665,888. CUT-OUT; W. L. R. Emmet, Schenectady, N. Y. App. filed July 27, 1899. (See Current News and Notes).

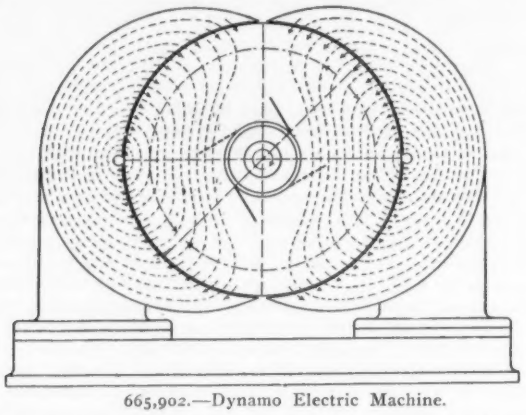
665,902. DYNAMO ELECTRIC MACHINE; H. E. Heath, Windsor, Conn. App. filed June 7, 1900. A dynamo electric machine having unwound pole pieces and a wound armature, with the planes of commutation of the armature circuits so arranged that the armature currents create magnetic flux through the armature and each pole-piece, the centre of which magnetic flux is approximately midway of the length of the pole-piece.

665,903. RHEOSTAT; E. M. Hewlett, Schenectady, N. Y. App. filed Nov. 13, 1900. A power driven rheostat comprising a motor and a limit device for cutting out the motor, automatically operated when the rheostat contact nears its limit of movement.

665,915. PROCESS OF ELECTROLYTIC PRODUCTION OF NICKEL OR ALLIED METALS; M. Kugel, Berlin, Germany. App. filed March 24, 1900. (See Current News and Notes.)

665,917. APPARATUS FOR OBTAINING RECIPROCATING MOTION; L. J. Le Pontois, Pittsburg, Pa. App. filed April 12, 1898. The invention consists, generally stated, in causing a conductor or conductors carrying current to be reciprocated in a unipolar magnetic field by the action exerted on the flux surrounding the conductor by the flux of the stationary field, the reciprocating motion of the conductor being obtained by reversing the current passing through the conductor.

665,921. COMBINED CIGAR LIGHTING AND CLIPPING DEVICE; C. A. Miller, Kansas City, Mo. App. filed Aug. 31, 1900. The device automatically restores the clipping mechanism to its original position and incidentally extinguishes the flame after the cigar has been clipped and lighted.



665,902.—Dynamo Electric Machine.

665,923. TELEPHONIC APPLIANCE; F. R. McBerty, Downer's Grove, Ill. App. filed Aug. 12, 1897. To avoid troubles arising from leakage of magnetism from one magnet to others closely adjacent, the magnets are provided with a mass of magnetic material forming a return circuit for the lines of force emanating from the core and an electrically conducting circuit encircling the core and the said return circuit.

665,928. ELECTRICAL CUT-OUT; C. G. Perkins, Hartford, Conn. App. filed Jan. 17, 1900. Details.

665,943. ELECTRIC CUT-OUT; J. H. Trumbull, Plainville, Conn. App. filed April 2, 1900. Details.

665,953. PROCESS OF ELECTROLYZING SOLUBLE SALTS; A. J. O. Chalandre and L. J. B. A. Colas, Paris France. App. filed March 21, 1899. (See Current News and Notes.)

665,957. RECEIVER FOR HERTZIAN ELECTRIC WAVES; E. Ducretet, Paris, France. App. filed May 22, 1899. (See Current News and Notes.)

665,986. LIGHTNING ARRESTER; W. D. Wood, Paris, Texas. App. filed June 5, 1900. The device serves the function of a lightning rod and consists of a strip of metallic cresting, having a conducting strand running through it and connected with the earth.

665,998. ACCELERATION LIMITING AND RECORDING DEVICE; A. G. Davis, Schenectady, N. Y. App. filed Sept. 29, 1900. A device mounted on a car and acting to record the number of times a predetermined acceleration or retardation is exceeded.

666,000. CIGAR LIGHTER; F. T. Dickerson, Chicago, Ill. App. filed May 5, 1900. The lighter is in the form of a cannon and contains a wick which projects from the mouth of the cannon, and is ignited by an electric spark when the cannon it tilted on its trunnions.

666,003. INSULATED ELECTRIC CONDUCTOR; W. L. R. Emmet, Schenectady, N. Y. App. filed Aug. 19, 1899. An electric conductor or cable provided with a helical winding of paper coated with a plurality of adherent layers of a vegetable oil, each layer being separately oxidized and hardened.

666,004. INSULATING ELECTRIC CONDUCTOR; W. L. R. Emmet, Schenectady, N. Y. App. filed Aug. 19, 1900. Relates to the preceding.

666,008. EDGEWISE WINDING APPARATUS; H. Geisenhoner, Schenectady, N. Y. App. filed Sept. 29, 1900. An apparatus for winding a flat metallic strip or ribbon edgewise, which comprises means for preventing the strip from buckling at the portion where it is being bent, and a non-circular former which is capable of movements of revolution and reciprocation.

666,067. ALARM SIGNAL; J. J. Ross, Detroit, Mich. App. filed March 26, 1900. Details.

666,080. ELECTRICALLY CONTROLLED AND OPERATED RAILWAY SWITCH; P. B. Williams, Washington, D. C. App. filed Oct. 11, 1900. In addition to the switch moving devices a pan is provided to catch dirt and the same is tilted to empty the dirt by electrical means.

666,121. MEANS FOR CONTROLLING ELECTRIC MOTORS; M. Waddell, New York, N. Y. App. filed March 23, 1887, renewed Jan. 18, 1897. (See Current News and Notes.)

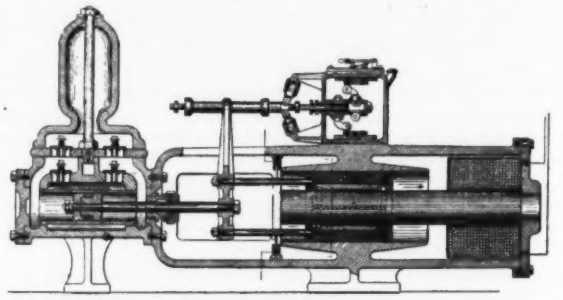
666,122. METHOD OF CONTROLLING ELECTRIC MOTORS; M. Waddell, New York, N. Y. App. filed Dec. 13, 1900. (See Current News and Notes.)

666,157. ELECTRIC WELDING APPARATUS; A. F. Rietzel, Lynn, Mass. App. filed Sept. 28, 1900. (See Current News and Notes.)

666,157. ELECTRIC WELDING APPARATUS; A. F. Rietzel, Lynn, Mass. Swampscott, Mass. App. filed July 3, 1899. (See Current News and Notes.)

666,162. TRANSFORMING APPARATUS FOR ELECTRIC METAL-WORKING; E. Thomson, Swampscott, Mass. App. filed July 3, 1899. (See Current News and Notes.)

666,177. TROLLEY FINDER FOR ELECTRIC CARS; E. S. Booth, Waterville, Maine. App. filed Sept. 19, 1900. Two curved arms are pivoted near the wheel and adapted to be thrown into a position above the wheel where they will form a V-shaped guide to direct the wire into the wheel.



665,917.—Apparatus for Obtaining Reciprocating Motion.

666,183. ELECTRO MAGNETIC BRAKE; F. L. Clarke, Pittsburg, Pa. App. filed May 14, 1900. An improvement on the preceding, by which the shoes throughout a double truck are applied by the movement of other shoes against the rail.

666,184. ELECTRO MAGNETIC BRAKE; F. L. Clarke, Pittsburg, Pa. App. filed May 14, 1900. Brake shoes, when acting upon the rail, react to throw other shoes against the wheels.

666,189. GONG TRIPPING MECHANISM; F. M. Dunn, Baltimore, Md. App. filed Jan. 31, 1900. Details.

666,199. GERMICIDE DEVICE FOR TELEPHONE TRANSMITTERS; A. B. Larsen, Minneapolis, Minn. App. filed April 27, 1900. A receptacle containing a disinfectant is attached to the transmitter.

666,213. TELEPHONE EXCHANGE CIRCUIT AND APPLIANCE; G. K. Thompson, Malden, Mass. App. filed Feb. 9, 1900. The first claim defines the invention as follows: The combination in a telephone-circuit, of two main conductors extending between a substation and a central station, and respectively forming portions of two associated sub-circuits; a third main conductor constituting a complementary and common portion of both of said sub-circuits; a condenser at the central station included in one of said sub-circuits; a source of transmitter-current supply at the central station connected in the other sub-circuit; a transmitter at the sub-station connected in the said complementary main conductor; and an induction-coil for said transmitter at the central station, having its two windings included in the said two sub-circuits respectively; substantially as set forth.

666,221. APPARATUS FOR DECOMPOSING SOLUTIONS; D. N. Hathorne and H. E. Hobson, Rumford Falls, Maine. App. filed Jan. 11, 1900. In an apparatus for the decomposition of solutions, a tank, a perforated chamber constituting the cathode, a diaphragm therefor, an outlet opening through the bottom of the diaphragm and the cathode, a chamber constituting the anode located in said cathode, and electrical connections between said cathode and anode and the source of electrical supply.